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Introduction

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Sept.-Oct.

Scientific and Technical Aerospace Reports (STAR) is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. It is published twice each month.

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- Scientific and technical reports of the National Aeronautics and Space Administration and its contractors.
- Scientific and technical reports of government agencies, universities, and research organizations throughout the world.

The first section of *STAR*, arranged in 34 categories, contains abstracts and bibliographic citations (see p. vi). A second section consists of five indexes: subject, corporate source, author, report/accession number, and accession/report number. Separate cumulative indexes are published quarterly, except for the fourth quarter, which is an annual index. Cumulative indexes also contain a contract number index.

Readers are encouraged to examine the abstracts in each category of interest. If time is short, and when interest is concentrated in specific areas, readers may wish instead to scan source, author, and subject indexes. A more thorough coverage of a subject field may often be achieved by detailed examination of the subject listings, especially as they are cross-indexed in the quarterly indexes.

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- Clearinghouse for Federal Scientific and Technical Information (CFSTI), Port Royal Road, Springfield, Virginia, 22151
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Organizations having a NASA contract may obtain *IAA* by writing NASA, Code USS-A, Washington, D.C., 20546. Others should direct inquiries to the American Institute of Aeronautics and Astronautics, 750 Third Avenue, New York, N.Y., 10017.

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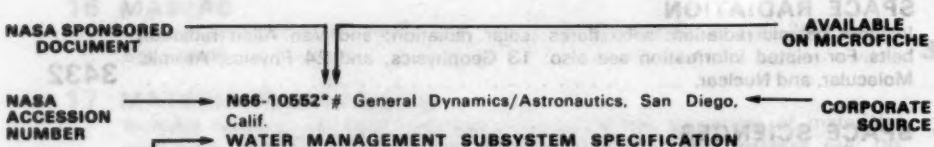
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N66-10552*# General Dynamics/Astronautics, San Diego, Calif.
CORPORATE SOURCE
TITLE
WATER MANAGEMENT SUBSYSTEM SPECIFICATION FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS. LIFE SUPPORT SYSTEM FOR SPACE FLIGHTS OF EXTENDED TIME PERIODS
PUBLICATION DATE
AUTHOR
J. A. Steele 30 Nov. 1965 31 p refs Revised
(Contract NAS1-2934)
(NASA-CR-67600; GD/A-64-28211, Rev. A) CFSTI: HC $2.00/MF $0.50 CSCL 06K
SALES AGENCY AND PRICE
CONTRACT OR GRANT
The water management subsystem specifications are presented for the equipment required in an operational water management program as an integral part of the life support system for space flight. The requirements of the subsystem components are summarized and the operational procedures for normal and emergency situations are outlined. Both the prototype and the flight systems are discussed. E.E.B.
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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

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N66-30100# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATING THE NON-STATIONARY FLOW AROUND A CASCADE OF THIN AIRFOIL BY A SUBSONIC GAS FLOW ACCORDING TO THE METHOD OF INTEGRAL EQUATIONS

V. B. Kurzin *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 209–222 refs (See N66-30086 17-23)

The problem of determining the forces operating on airfoils in a cascade with an arbitrary stagger oscillating according to harmonic law in the subsonic flow of a gas is examined.

Author

N66-30346*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

FIN: A COMPUTER PROGRAM FOR CALCULATING THE AERODYNAMIC CHARACTERISTICS OF FINS AT SUPERSONIC SPEEDS

James S. Barrowman Apr. 1966 45 p refs

(NASA-TM-X-55523; X-721-66-162) CFSTI: HC $2.00/MF $0.50 CSCL 01A

By numerical solution of Busemann's Second Order Airfoil Theory and the spanwise summing of airfoil strips, FIN determines the pressure coefficient distributed over a given fin configuration moving at supersonic speeds. In determining the distribution, the program can include the effect of a fin-tip Mach cone. From this basic calculation, FIN can determine as functions of angle of attack the lift coefficient, wave drag coefficient, pitching moment coefficient, and center-of-pressure location, and as a function of fin cant angle the rolling moment coefficient. FIN can also determine the lift coefficient slope, wave drag at zero angle of attack, pitching moment coefficient slope, rolling moment coefficient slope, and center-of-pressure location at zero angle of attack as functions of Mach number. Comparisons with wind tunnel data show that predicted values using FIN output fall well within 10% of experiment results.

Author

N66-30651# ARO, Inc., Arnold Air Force Station, Tenn.

LAUNCHING OF FOAMED PLASTIC MODELS WITH A TWO-STAGE LIGHT-GAS GUN

A. B. Bailey and K. E. Koch Arnold Eng. Develop. Center, May 1966 28 p refs

(Contract AF 40(600)-1200)

(AEDC-TR-66-60; AD-632924) CFSTI: HC $2.00/MF $0.50

Techniques were developed to launch ultralightweight models (i.e., densities on the order of 1 lb/cu. ft.) from a two-stage light-gas gun. To date, spheres and cones have been launched with some success. The purpose of the development was to determine whether useful aerodynamic data (e.g., sphere drag) could be obtained in a short aeroballistic range at pressures on the order of 0.01 mm Hg. A number of spheres were launched in support of this effort, some at pressures as low as 0.03 mm Hg. There is good agreement between these measurements of sphere drag coefficient and those produced in low-density wind tunnels. The application of this technique to a longer range having a lower pressure capability, say, 0.001 mm Hg, would permit measurements to be made in the near-free-molecule flow regime.

Author (TAB)

N66-30660# ARO, Inc., Arnold Air Force Station, Tenn.

SPHERE DRAG MEASUREMENTS IN AN AEROBALLISTICS RANGE AT HIGH VELOCITIES AND LOW REYNOLDS NUMBERS

A. B. Bailey Arnold Eng. Develop. Center, May 1966 44 p refs

(Contract AF 40(600)-1200)

(AEDC-TR-66-59; AD-633278) CFSTI: HC $2.00/MF $0.50

The drag coefficients of spheres for $Re_2 > 10^4$ have been measured in the velocity range $3000 < V_\infty < 21,000$ ft/sec with an accuracy of approximately ±1.5%. In addition, successful techniques for manufacturing and launching ultralightweight spheres (densities approaching 1 lb/ cu ft) have resulted in the ability to measure sphere drag coefficient in the velocity range $3000 < V_\infty < 12,000$ ft/sec and Reynolds number range $3 < Re_2 < 10^6$, with an accuracy of approximately ±4%. This wide range of operating conditions has made it possible to study the initial departures of sphere drag coefficient from the high Reynolds number, continuum level and also to make measurements at free-stream Knudsen numbers approaching 1.0. The results of the tests at the low Reynolds numbers are shown to be consistent with the results obtained in other low-density, hypersonic-flow facilities.

Author (TAB)

N66-30689# David Taylor Model Basin, Washington, D. C.
LITERATURE SEARCH AND COMPREHENSIVE BIBLIOGRAPHY OF WINGS IN GROUND EFFECT AND RELATED PHENOMENA
William F. Foshag Mar. 1966 106 p refs
(DTMB-2179; DTMB-AERO-1098; AD-633139) CFSTI: HC $4.00/MF $0.75

A comprehensive survey and literature search is made of the general field of wings operating in ground effect and related phenomena. Comments are included of some of the papers published, to present a sketch of the methods of approach of a number of authors. The bibliography presents sources which consider the problem from the theoretical, experimental, and/or applications point of view. Tables are included which provide a convenient breakdown of the various sources, for a quicker method of locating specific references dealing with an area of special interest to the reader.
Author (TAB)

N66-30719# David Taylor Model Basin, Washington, D. C.
WIND-TUNNEL INVESTIGATION OF THE HOVERING, TRANSITION, AND CRUISING PERFORMANCE OF AN ARRESTED ROTOR (TRIDENT) VTOL AIRCRAFT CONCEPT Final Report
Gary W. Brasseur and William B. Maguire Feb. 1966 43 p refs
(DTMB-2172; DTMB-AERO-1101; AD-632777) CFSTI: HC $2.00/MF $0.50

Wind-tunnel tests were conducted to evaluate static-stability and control characteristics with emphasis on determining the magnitude of transition problems. Evaluating the compatibility of the competing internal and external aerodynamic requirements for high static lift and efficient cruising was an additional test objective. Test results show that the model exhibits a strong directional trim shift through transition. The pattern selected for rotor arrestment during evaluation of the transition characteristics was not acceptable on the basis of power required to support vehicle weight or control of trajectory. The results further indicated that the performance potential of the ducted rotor–nozzle system may be limited because of the structural requirements. Model rotor duct design, from the standpoint of internal aerodynamics, was compromised by adding structure to accommodate the wing bending loads for high-speed cruising. Author (TAB)

N66-30742# Catholic Univ. of America, Washington, D. C. Dept. of Mechanical Engineering.
THE REATTACHMENT OF LAMINAR CAVITY FLOW WITH HEAT TRANSFER AT HYPERSONIC SPEED
Paul K. Chang 30 Apr. 1966 65 p refs
(Grant AF-AFOSR-706-65)
(AFOSR-66-0135; AD-632797) CFSTI: HC $3.00/MF $0.75

A study of cavity flow is made based upon the analysis of a physical model and by referring to the experimental data of a particular test model with the reattachment surface perpendicular to free stream direction at free stream Mach number of eleven. The pressure and heat transfer in the reattachment zone may be predicted approximately by the flow quantities along the dividing stream line employing the mixing theory and stagnation heat transfer equation for a blunt body. Good agreement with experimental data is obtained. It is found that the value of the average mixing rate correlation function for the cavity flow is 15 and is equal to that value determined by Glick for separated flow caused by shock impingement. Semi-empirically, efficiency factor of compression equal to 0.67 at the reattachment is evaluated and the reattachment velocity gradient parameter for the particular test model is similar to this case of stagnation flow over blunt nose. It appears that the heat transfer at the reattachment surface perpendicular to the free stream direction may be predicted approximately by the stagnation point heat transfer equation for a two-dimensional blunt surface. Author (TAB)

N66-30804# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
AERODYNAMIC STUDY OF TURBULENT BURNING FREE JETS WITH SWIRL
N. A. Chigier and A. Chervinsky Apr. 1966 36 p refs To be presented at 11th Intern. Symp. on Combust., California Univ., 14–20 Aug. 1966
(TAE-49) CFSTI: HC $2.00/MF $0.50

Velocity and temperature measurements have been made in a series of turbulent swirling free flames. Premixed butane–air jets issued from a round orifice with exit velocities of 60m/sec and the degree of swirl was varied by varying the ratio of the flow rates of air supplied tangentially and axially to the burner. The flames were stabilized some 4 diameters from the burner exit in the shape of an annular ring and were unconfined for a distance of 24 diameters. The measurements made in this region for 3 different degrees of swirl show that the decay of axial and swirl velocities is slower in a flame than in cold swirling jets. The turbulent burning velocity was found to be 80 times greater than the laminar burning velocity and the velocity gradient in the outer region of the jet where the flame was stabilized was 250 sec^{-1}. In the theoretical analysis the turbulent equations of motion, energy, and state have been integrated to obtain expressions for the decay along the axis of the maximum values of axial velocity, swirl velocity and temperature. Variations in flame shape are described in terms of velocity decay constants and Gaussian error curve constants for radial spread of temperature and velocity. Author

N66-30852*# Wyle Labs., Inc., Huntsville, Ala.
AERODYNAMIC NOISE RESEARCH SUPPORT Quarterly Progress Report, Jan.–Mar. 1966
M. V. Lowson 8 Apr. 1966 7 p refs
(Contract NAS8-11308)
(NASA-CR-76358) CFSTI: HC $1.00/MF $0.50 CSCL 01A

This report summarizes the research progress on aerodynamic noise contained in two technical reports concerned with the acoustic environment due to separated flows and oscillating shocks, and flow visualization experiments with supersonic separated turbulent flow. Additional work performed during this period included refinement of the theoretical work on surface pressure fluctuations due to shock turbulence interaction and the initiation of experimental work on subsonic separated flows. The experimental rig for the latter investigation was modified and improved, and a photograph of the improved separated flow section is included. R.N.A.

N66-31127# Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
THEORETICAL PREDICTION OF THE FLOW IN THE WAKE OF A HELICOPTER ROTOR. PART 2: FORMULATION AND APPLICATION OF THE ROTOR-WAKE-FLOW COMPUTER PROGRAM Final Report, Sep. 1964–Sep. 1965
Peter Crimi Sep. 1965 93 p refs
(Contract DA-30-069-AMC-645(R))
(CAL-BB-1994-S-2; AD-629782) CFSTI: HC $9.00/MF $0.75

A study was performed with the objective of predicting the time-varying flow in the vicinity of a helicopter in hovering or forward flight. An analytical model was formulated

which represents the rotor, its wake and the fuselage of the aircraft. The model for the wake has been simplified in a manner consistent with flow visualization studies by representing the wake as tip vortices emanating from each blade. The wake vortices are assumed to be free to convect under the influence of the blades, the fuselage and the wake itself. The fuselage has been replaced by a surface distribution of sources, the strength per unit are being determined by assuming that the fuselage is subjected to a uniform, steady free stream. A digital computer program was written which implements the model developed. Flow calculations were performed which agree well with measurements of the time average of the flow in the wake of two-bladed rotor. Extensive calculations were then carried out which define the flow in the vicinity of a UH-1B helicopter for a range of flight conditions from hover to high-speed cruise. Upon analysis of the results, it was concluded that the model developed provides a valid representation of the unsteady flow in the vicinity of a helicopter. It was pointed out that the formulation is somehwat restrictive, in that the flow in the rotor plane and immediately adjacent to the fuselage cannot be accurately predicted. However, the suitable refinements incorporated, these regions could be investigated as well. Author (TAB)

N66-31208*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

FLUTTER STUDIES OF SIMPLIFIED COMPONENT MODELS OF A VARIABLE-SWEEP WING AIRPLANE AT MACH NUMBERS UP TO 3.0

Maynard C. Sanford, Charles L. Ruhlin, and Irving Abel Washington, NASA, Jul. 1966 45 p refs

(NASA-TN-D-3501) CFSTI: HC $2.00/MF $0.50 CSCL 01A

Wind-tunnel flutter trend studies of simplified component models of a variable-sweep-wing airplane have been conducted at Mach numbers from about 0.6 to 3.0. The model configurations investigated included an aspect-ratio-9 wing at sweepback angles of 16°, 39°, and 73°, an aspect-ratio-8 wing at a sweepback angle of 16°, an all-movable horizontal tail which had a 20° sweptback pitch axis, and a vertical tail (including a rudder) with and without a tip weight (radome). The model flutter panels consisted of tapered plates cut to the desired planform with wedge-shaped leading and trailing edges. All models of a given component approximated the fundamental vibration modal characteristics of the respective airplane component. Author

N66-31242# Technische Hochschule Aachen (West Germany). Aerodynamischen Institut.

TRANSACTIONS OF THE AERODYNAMIC INSTITUTE OF THE RHEIN-WESTPHALIAN TECHNICAL UNIVERSITY IN AACHEN, VOLUME 18 [ABHANDLUNGEN AUS DEM AERODYNAMISCHEN INSTITUT AN DER RHEINISCH-WESTFALISCHEN TECHNISCHEN HOCHSCULE IN AACHEN, HEFT 18]

A. Naumann Jan. 1965 46 p refs In GERMAN

CFSTI: HC $2.00/MF $0.50

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02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N66-29989# Aviation Safety Engineering and Research, Phoenix, Ariz.

AIRCRAFT LITTER RETENTION SYSTEM DESIGN CRITERIA Final Technical Report

Langston W. T. Weinberg Ft. Eustis, Va., Army Aviation Materiel Labs., Apr. 1966 67 p refs

(Contract DA-44-177-AMC-254(T))

(USAAVLABS-TR-66-27; AvSER-65-13; AD-632457) CFSTI: HC $3.00/MF $0.75

Strength requirements of U. S. Army litter/patient retention systems as set forth in current military specifications were analyzed. The analysis was made in light of U.S. Army aircraft accident experience, the human tolerance to abrupt accelerations, and the forces and accelerations that may be anticipated in accidents involving litter-bearing military aircraft. The analysis revealed that the strength requirements quoted in current military specifications are considerably lower than (1) the upper limits of acceleration that can be tolerated by airborne litter occupants and (2) the typical forces and accelerations that are incurred in military aircraft accidents. These conclusions indicated that current litter systems would fail under relatively moderate impact conditions and would thus subject the litter patient to amplified accelerations and increased contact injuries. The existing litter system was analyzed in detail to determine if minor modifications could be made to achieve a vertical load-carrying capability of 20G. Since this strength was not attainable, an experimental litter system designed for a 20G vertical and 25G longitudinal capability was developed. Author (TAB)

N66-29995# Army Cold Regions Research and Engineering Lab., Hanover, N. H.

PERFORMANCE TESTING OF AN AIR CUSHION VEHICLE ON THE GREENLAND ICE CAP

Gunars Abele Feb. 1966 24 p refs

(CRREL-SR-91; AD-632570) CFSTI: HC $1.00/MF $0.50

During the summer of 1964, performance tests were conducted on the Greenland Ice Cap to determine and evaluate the feasibility of the air cushion vehicle concept as a transportation method in polar regions. Results from tests with the Bell tri-cell plenum air cushion vehicle indicated that the test vehicle can cruise over an undisturbed snow surface at speeds up to 35 mph and produce a maximum speed of 42 mph. The

test vehicle was capable of ascending a 6 to 10% slope against a 15-knot wind, traveling over soft snow drifts up to 30 inches high, and crossing ditches of at least a 5-ft width. The payload capacity of the vehicle was approximately 1000 lb, not including the operator and fuel. The skirt-lifting sideforce concept and the harrow disk attachment proved to be very effective for control and maneuverability of the vehicle. Author (TAB)

N66-30081*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

GROUND MEASUREMENTS OF SHOCK-WAVE PRESSURE FOR FIGHTER AIRPLANES FLYING AT VERY LOW ALTITUDES AND COMMENTS ON ASSOCIATED RESPONSE PHENOMENA

Domenic J. Maglieri, Vera Huckel, and Tony L. Parr** Washington, NASA, Jul. 1966 72 p refs

(NASA-TN-D-3443) CFSTI: HC $3.00/MF $0.75 CSCL 01B

Shock-wave pressure ground measurements for two supersonic low-flying fighter aircraft are correlated with window-glass breakage and theoretical data. Measurements during this flight test program were in the Mach number range of about 1.05 to 1.16 and at altitudes between 50 and 890 feet. Pressure time histories measured at ground level had more peaks than would be obtained at ground level for high altitude flights; and the pressure rises across the bow shock wave decreased with increasing altitude, as predicted theoretically. Of 214 possible window breakages, 51 actually occurred within the pressure range of about 20 to 100 lb/sq ft, and more damage occurred for time histories having longer time durations of the first positive pressure rise across the shock wave. M.W.R.

N66-30149# Federal Aviation Agency, Washington, D. C.

INSPECTION OF TRANSPORT AIRCRAFT FOR RADIOACTIVE CONTAMINATION [UBERWACHUNG VON VERKEHRSFLUGZEUGEN AUF RADIOAKTIVE VERSCHMUTZUNG]

G. Nagel [1965] 20 p refs Transl. into ENGLISH from a German paper

The extent of radioactive dust deposit on civil jet aircraft was measured and monitored over a period of three and one half years. The causes of these deposits, as well as steps which may be taken for prevention are discussed. The differences are noted among radioactive dust deposits on aircraft making North Atlantic and Polar flights, and aircraft making other runs. The weather conditions are posited as a cause of this. It is also concluded that radioactive dust remains suspended in the stratosphere for a period of about two years after a nuclear explosion. Provided that no further explosions take place in the atmosphere, the already existing trend of dust deposit increase would seem to have to continue. D.T.

N66-30177*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYSIS OF BOUNDARY-LAYER TRANSITION ON X-15-2 RESEARCH AIRPLANE

Albert L. Braslow Washington, NASA, Jul. 1966 18 p refs

(NASA-TN-D-3487) CFSTI: HC $1.00/MF $0.50 CSCL 01B

An analysis of fuselage and wing thermocouple data obtained during a X-15-2 research airplane flight and of measurements of surface discontinuities and structural roughness made after the flight has provided a strong quantitative indication that premature boundary-layer transition on the airplane was controlled by surface protuberances. Turbulent flow existed on the entire fuselage at all times during the flight as a result of a forward-facing step between the high-speed flow-direction sensor and the fuselage. Premature transition that varied in location during the flight was induced on the wing by a spanwise step caused by a skin joint near the wing leading edge and by leading-edge expansion-joint covers. The movement in the location of transition on the wing was rather conclusively related to changes in roughness Reynolds number during the flight, but the exact transition location is unpredictable for the two-dimensional-type roughness present. No structural roughness of a three-dimensional type of sufficient height to cause premature transition during the temperature-measuring phase of flight was found on the airplane. Author

N66-30290# Princeton Univ., N. J. Dept. of Aerospace and Mechanical Sciences.

A SURVEY OF V/STOL WIND TUNNEL WALL CORRECTIONS AND TEST TECHNIQUES

John W. Olcott Dec. 1965 163 p refs

(Contract Nonr-1858(14))

(Rept.-725; AD-629004) CFSTI: HC $3.00/MF $0.75

A discussion of wind tunnel boundary corrections as they apply to VTOL model testing is presented. Conventional wall correction theory is inadequate since it fails to account for both the presence of a highly developed wake and the total lift acting on the model. Correction theories that do consider the lift and wake characteristics of VTOL designs give satisfactory results, provided there is no wake distortion due to the interference of tunnel walls. Both the Heyson and Kirkpatrick VTOL boundary correction theories are examined and their limitations discussed. A comparison of free air and tunnel results for a .165 scale North American Aviation Tilt Wing design and a free air study of an early Hamilton Standard XC 142 propeller model are discussed. The propeller data agreed with theoretically predicted values, but discrepancies, particularly in drag force, appeared when the airship North American Aviation data were compared with similar tunnel results. The exact cause of the differences was not determined. The importance of the VTOL model wake is substantiated. Minimum tunnel sizes necessary to avoid wake impingement and disturbance are presented. Author (TAB)

N66-30715# Bell Aerosystems Co., Buffalo, N. Y.

APPLICATION OF PILOT–CONTROLLER INTEGRATION TECHNIQUES TO A REPRESENTATIVE V/STOL AIRCRAFT Final Report

John W. Gaul Wright-Patterson AFB, Ohio, AF Flight Dyn. Lab., Oct. 1965 154 p refs *Its* Rept.-2226-903001

(Contract AF 33(615)-1866)

(AFFDL-TR-65-200; AD-633269) CFSTI: HC $5.00/MF $1.00

The report presents final results of a study of the application of Pilot–Controller Integration (PCI) design techniques to the flight control system of a representative V/STOL aircraft. Under this program the validity of the concept was established in the application to the X-22A V/STOL. In this application the PCI technique indicated the areas of the X-22A flight control system where modifications would result in the greatest improvement to the probability of mission accomplishment. Design modifications were made and an iteration using the technique was accomplished and the payoff was evaluated. The digital program which was developed and applied to the X-22A has general applicability to other aircraft. Several improvements to this program as well as to the details of technique application are suggested. Author (TAB)

N66-30727# RAND Corp., Santa Monica, Calif.

THERMAL PROTECTION FOR LIQUID-HYDROGEN FUEL TANKS IN HIGH SPEED, LONG-RANGE AIRCRAFT

W. D. Gosch Oct. 1965 66 p refs
(Contract AF 49(638)-66-C-001; Proj. RAND)
(RM-4286-PR; AD-625407) CFSTI: HC $3.00/MF $0.75

Part of a continuing study of cryogenic-fuel systems is presented. An analysis is presented of requirements for thermal protection systems and of fuel boil-off for liquid-hydrogen tanks aboard hypersonic, long-range aircraft. From this analysis it should be possible to obtain preliminary approximations of the weights of fuel boil-off and thermal protection systems over a wide spectrum of tank sizes and heat inputs. Author (TAB)

N66-31112# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EXTERNAL LOADS AND STRENGTH OF FLYING APPARATUSES
A. I. Gudkov, P. S. Leshakov, and L. G. Ryakov 20 Jul. 1965 632 p refs Transl. into ENGLISH of the book "Vneshniye Nagruzki i Prochnost' Letatel'nykh Appartov" Moscow, Gos. Izd. Nauch.-Tekhn., 1963 p 1–480
(FTD-MT-64-526; TT-65-64167; AD-622400)

This book is dedicated to external loads having effect on a flight vehicle (aircraft and helicopter), and the durability of its construction. Basic attention in the book is allotted to actual problems of strength of contemporary flight vehicles; dynamic load, periods of service and strength of construction, strength during high speeds of flight, taking into account aerodynamic heating and others. Along with an account of theoretical questions in the book there are described experimental methods of investigating strength of construction. The book is designed for engineers connected with designing, tests, and exploitation of flight vehicles. At the same time, it can be used as a training aid for aviation students of higher educational institutions. Author (TAB)

N66-31115# Army Aviation Materiel Labs., Fort Eustis, Va.
OV-1A MOHAWK FLIGHT LOADS INVESTIGATION PROGRAM
David Chestnutt Jan. 1966 57 p ref
(USAAVLABS-TR-66-6; AD-629632) CFSTI: HC $8.60/MF $0.75

A primary objective of this effort was to provide operational data for establishing future short takeoff and landing (STOL) aircraft design criteria. To accomplish this end, two OV-1A aircraft were selected that were participating in air-assault maneuvers. Approximately 200 hours of flight data were recorded within approximately 10 weeks. The parameters recorded were: airspeed, altitude, outside air temperature, and acceleration at the aircraft center of gravity. In addition, supplementary data were collected on the type of mission and gross weight of the aircraft. These data are presented as several frequency-of-occurrence forms, exceedance curves, and gust spectra. Author (TAB)

N66-31150# Kansas Univ., Lawrence.
GEM RESEARCH AT THE UNIVERSITY OF KANSAS Technical Report, Oct. 1963–Dec. 1965
Costas J. Choliasmenos, William F. Teague, V. Sundararajan, and James B. Tiedemann 30 Dec. 1965 97 p refs
(Contract Nonr-4201(00))
(TR-1; AD-629725) CFSTI: HC $3.00/MF $0.75

Overland maneuvering of a ground effect machine in close quarters at low speeds is extremely difficult. Novice pilots tend to scan the control axes cyclically, and to pulse the controls to maximum excursion in the manner of an off–on servomechanism rather than a proportional controller. Control is simplified by disabling the lateral acceleration system, or by utilizing an automatic lateral drift stabilizer. Lateral friction resulting from wheel contact at light pressure enormoulsy improves the overland handling qualities of a ground effect machine. Even the most rudimentary flight simulator provides valuable experience in the unique 'feel' of a ground effect machine, and gives effective forewarning of what to expect at the controls of a real machine. It is theoretically possible to build an 'inverted' ground effect machine, that inhales outside air into the cushion area and vents it to a propulsion duct. Such a device offers potential reductions in spray and dust problems and attractive structural features for shipboard stowage, at the expense of difficulty in heave stability. Static stability of the pressurized structure of the 'inverted' GEM has been investigated in detail, and some progress has been made toward flutter analysis of its flexible elements. Author (TAB)

N66-31208*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL STABILITY AND CONTROL CHARACTERISTICS OF A POWERED MODEL OF A TWIN-PROPELLER DEFLECTED-SLIPSTREAM STOL AIRPLANE CONFIGURATION
Richard J. Margason, Alexander D. Hammond, and Carl L. Gentry Washington, NASA, Jul. 1966 139 p refs
(NASA-TN-D-3438) CFSTI: HC $4.00/MF $0.75 CSCL 01C

Results are presented of a wind-tunnel investigation of the static longitudinal stability and control capabilities of a twin-propeller deflected-slipstream STOL airplane in the take-off and landing speed range through the post-stall region at angles of attack up to 44°. The results of this investigation show that the magnitudes of the pitching moments of the wing–body combination for the flaps-retracted (0° flap deflection) configuration were small. The tail-on data show that any of the tail configurations with the flaps-retracted configuration provide an adequate stability contribution and are capable of trimming the airplane. The wing-body combination for the flaps-deflected (45° flap deflection) configuration had a large tail lift requirement for longitudinal trim, particularly for the highest power capability of trimming the airplane for the low power conditions (thrust coefficients of 0 and 0.70). At higher power conditions the tail stalled before trim was achieved. Author

N66-31209*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
GROUND-RUN TESTS WITH A BOGIE LANDING GEAR IN WATER AND SLUSH
Robert C. Dreher and Walter B. Horne Washington, NASA, Jul. 1966 50 p refs
(NASA-TN-D-3515) CFSTI: HC $2.00/MF $0.50 CSCL 01B

Ground-run tests were made with a bogie-type landing gear on water- and slush-covered runways to obtain data on fluid-displacement drag, wheel spin-down, wheel spray patterns, and fluid-spray drag. Tests were made with the normal four-wheel (dual tandem) configuration and with configurations consisting of one and two wheels at different locations on the bogie truck. The ground speeds ranged from 15 to 110 knots and the runway fluid depths ranged from 0.15 to 2.0 inches (0.38 to 5.08 centimeters). Tire inflation pressures were 25, 50, and 75 pounds per inch^2 (17.2, 34.5, and 51.7 newtons per centimeter^2), and the vertical load per tire was approximately 5000, 6000, or

12,000 pounds (22,200, 26,688, or 53,378 newtons) depending on the wheel configuration. Some tests were also made with a simulated wing flap mounted to the rear of the wheels in the take-off and landing positions. In addition, a few tests were made with a spray alleviator mounted between the wheels of the dual-tandem wheel configuration. Results indicated that ground speed, vertical load, tire pressure, fluid density, fluid depth, and wheel location affected the fluid-displacement drag, the wheel spin-down characteristics, the wheel spray patterns, and the fluid-spray drag developed by this landing gear. Author

N66-31210*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EXPERIMENTS ON THE EFFECTS OF ATMOSPHERIC REFRACTION AND AIRPLANE ACCELERATIONS ON SONIC-BOOM GROUND-PRESSURE PATTERNS
Domenic J. Maglieri and David A. Hilton (NASA, Flight Res. Center) Washington, NASA, Jul. 1966 33 p refs
(NASA-TN-D-3520) CFSTI: HC $2.00/MF $0.50 CSCL 01B

A special series of sonic-boom flight tests has been conducted with a fighter airplane in the altitude range from 33,500 to 52,500 feet (10,211 to 15,911 meters) at Mach numbers to 2.0 in an attempt to define better the lateral extent of the sonic-boom pressure pattern during steady supersonic flight and the superboom and multiple-boom regions during accelerated flight for quiescent atmospheric conditions. Ground-pressure measurements have been obtained for lateral distances up to about 35 miles (56,315 meters) to each side of the flight track during the steady-level flight conditions and for distances of about 23 miles (37,007 meters) along the flight track for the acceleration and low Mach number steady-level flights. The lateral-spread phenomena appear to be fairly well understood and predictable for current and future supersonic airplanes. The highest overpressures are measured on the ground track and decrease with increasing lateral distance. Pressure buildups occur in the superboom region for longitudinal accelerations at constant altitude, and these are followed by a region of multiple booms wherein the pressures are of the order of magnitude predicted for comparative steady-level flight conditions. Author

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N66-29999# American Cynamid Co., Stamford, Conn. Research Labs.
HYDROCARBON FUEL CELL ELECTRODES Progress Report, Jul. 16, 1965–Jan. 15, 1966
V. Corso, Jr. 22 Apr. 1966 52 p ref
(Contract DA-44-009-AMC-897(T))
(PR-2; AD-632531) CFSTI: HC $3.00/MF $0.50

Progress is reported on a program aimed at the development of an electrode system which will produce 20 w/sq ft at a minimum of 0.4 volt in a phosphoric-acid matrix type cell utilizing a liquid hydrocarbon fuel (n-octane) and air, with a total platinum loading of not more than 20 g/sq ft. Emphasis was placed on evaluating the performance of standard and experimental electrodes on normal octane and air at temperatures in the range 150 to 200°C. Author (TAB)

N66-30035# Harry Diamond Labs., Washington, D. C.
HADOPAD RADAR ACTUATOR DESIGN AND PERFORMANCE
John J. Roach and Malcolm L. Wiseman Feb. 1965 92 p refs
(TM-66-2; AD-632572) CFSTI: HC $3.00/MF $0.75

A low-cost radar actuator for use as a component in a delayed-opening parachute aerial-delivery system has been developed. This device is known as HADOPAD (High-Altitude Delayed-Opening Parachute Actuating Device). The device, based on radar principles, will open a main recovery parachute at either of two preset heights (1000 or 1700 ft) above the ground. The complete system utilizes a drogue-parachute stabilizing stage for free fall from high altitude followed by a main parachute recovery stage which is initiated at low altitude by the radar actuator. Limited field testing of the radar actuator at Fort Devens, Mass. has shown the feasibility of the device as a parachute actuator, but some additional engineering and complete environmental tests are necessary before initiation of quantity production. Forty actuators were constructed by HDL during the research and development phase. Author (TAB)

N66-30077*# Gulton Industries, Inc., Metuchen, N. J.
INVESTIGATION OF STERILIZATION OF SECONDARY BATTERIES Quarterly Progress Report No. 1, Oct. 28, 1965–Jan. 26, 1966
John Liska [1966] 23 p
(Contract NAS1-5708)
(NASA-CR-66105) CFSTI: HC $1.00/MF $0.50 CSCL 10C

Separator materials were evaluated for use in a sterilized nickel–cadmium cell which will have a power density and cycle life approximately the same as a standard Ni–Cd cell. Very little change in length or width of asbestos cloth was noted after testing heating to 145°C for 36 hours in a sealed container while being immersed in a potassium hydroxide solution. The asbestos material was lighter in color and more brittle after testing, and there was a large decrease in its weight and thickness. Approximately the same results were obtained in both 34% and 45% KOH. Various other separator materials were tested, and the resulting shrinkages in polypropylene and polypropylene–nylon separators were sufficiently pronounced to prevent wrapping of packs prior to heat sterilization. It was found that a sterilization procedure can be employed as a pre-treatment for these separators prior to cell wrapping. Fabrication and preliminary testing are reported for cells with separators of asbestos, polypropylene, and polypropylene–nylon. M.W.R.

N66-30142# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
A STUDY OF THE EFFECTS OF ENVIRONMENTAL NOISE ON THE PERFORMANCE OF FLUID AMPLIFIERS
Charles Jasper Hansen (M.S. Thesis) Mar. 1966 44 p refs
(AD-632396) CFSTI: HC $2.00/MF $0.50

The effects of environmental noise on the static performance of two bistable fluid amplifiers were studied. Plots of differential control pressure versus differential output pressure were made by varying input pressure to one control. In addition to sound frequency and pressure level, variables considered included amplifier configuration, orientation, and

supply pressure. Tests were run at frequencies of 100, 200, 500, 1000, and 2000 cps and sound pressure levels ranging from 151 to 157 dB. The effects noted varied widely and included decreased hysteresis, instability, and complete loss of bistable characteristics. The phenomena of jet spreading, radiation pressure, and acoustic streaming were related to these effects. Author (TAB)

N66-30542*# Harshaw Chemical Co., Cleveland, Ohio. Crystal-Solid State Div.
RESEARCH AND DEVELOPMENT IN CdS PHOTOVOLTAIC CELLS Third Quarterly Report, 29 Dec. 1965-29 Mar. 1966
J. C. Schaefer, E. R. Hill, and T. A. Griffin [1966] 34 p refs
(Contract NAS3-7631)
(NASA-CR-54996) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Barrier formation studies were made on the rate of Cu_2S formation and the diffusion of the Cu_2S in CdS. The rate of Cu_2S formation is in proportion to the Cu^+ ion solution concentration. Theoretical and experimental curves based on the increase of Cu_2S mass per unit times show good agreement. The diffusion of Cu_2S in CdS appears constant at approximately $10^{-9} cm^2$ per second. Several cells were produced and delivered with efficiencies in the range of 5 to 6%. The maximum value was 5.8%. The average cell efficiency has not kept pace with this improvement. The electroplated grid technique continues to provide reliable cell units. An alternate pressure-temperature technique has been used to attach the grids. Preliminary results show that it may provide a high reliability cell unit. This is based on a 600 thermal cycle test. Author

N66-30700# Giannini Controls Corp., Malvern, Pa. Astromechanics Research Div.
DEVELOPMENT OF TECHNIQUES FOR THE STATIC AND DYNAMIC ANALYSIS OF FLUID STATE COMPONENTS AND SYSTEMS Final Report, Mar. 1-Oct. 31, 1965
Charles A. Belsterling Ft. Eustis, Va., Army Aviation Materiel Labs., Feb. 1966 80 p refs
(Contract DA-44-177-AMC-284(T))
(ARD-FR-037; USAAVLABS-TR-66-16; AD-633311) CFSTI: HC $3.00/MF $0.75

The report describes development of analytical techniques necessary for design of systems using fluidic components. It covers the analytical and experimental work on five separate tasks intended to extend the usefulness of previously conceived methods. The results lead to the following conclusions: (1) valid equivalent circuits were developed to describe the dynamic behavior of most fluid amplifiers, (2) these equivalent circuits are useful for frequencies from zero through 2000 cps, (3) the validity of certain methods previously developed for evaluating equivalent circuit elements was confirmed, (4) static characteristic curves of amplifier performance of the type developed under the program can be normalized, thereby minimizing the number of sets of curves necessary to describe the behavior of an amplifier, and (5) the mathematical model derived for a simple impedance element is valid for low values of through-flow; additional work is needed to modify it for high through-flow values. Author (TAB)

N66-30723# Sonotone Corp., Elmsford, N. Y.
STANDARD LINE-BATTERY ASSEMBLY BB-810( )/U NICKEL CADMIUM VENTED Quarterly Report No. 2, 29 Oct. 1965-28 Jan. 1966
Raymond Nathe, John Herrmann, Arthur Fitchman, and Elmer A. D'Onofrio Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 30 p
(Contract DA-28-043-AMC-01508(E))
(ECOM-01508-2; AD-633060) CFSTI: HC $2.00/MF $0.50

This report covers the research and development activities which have been directed towards the design of a 12-volt, vented, nickel-cadmium battery housed in a reinforced fiberglass container, and capable of surviving four-foot, free-fall drops. Based upon our test results, certain modifications on the container were made, subsequently followed by a new series of drop tests. These test results proved out the acceptability of the new modifications, since no significant damage to the container was found at the end of 26 completed drops. Author (TAB)

N66-30734# Allis-Chalmers Mfg. Co., Milwaukee, Wis. Space and Defense Sciences Dept.
DESIGN OF HYDROGEN-OXYGEN CAPILLARY TYPE FUEL CELL Quarterly Technical Progress Report, 1 Feb.-30 Apr. 1966
16 May 1966 25 p
(Contract AF 33(615)-1185)
(QTPR-10; AD-632700) CFSTI: HC $1.00/MF $0.50

A successful operational test of the orbital fuel cell package after 24 months of storage and after the severe shock and temperature extremes experienced due to the abortive flight attempt demonstrated the extended storage capability and ruggedness of the capillary fuel cell. An operational test of module number 1 in May 1966 will complete the 90-day storage qualification test. Thermal-vacuum qualification testing cannot be started until fuel cell plates for the test modules are received and the modules can be assembled. Author (TAB)

N66-30737# Yardney Electric Corp., New York.
DEVELOPMENT OF THE METAL-AIR BATTERY SYSTEM First Quarterly Report, 1 Jul.-30 Sep. 1965
Allen Charkey Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 67 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01614(E))
(ECOM-01614-1; AD-632717) CFSTI: HC $3.00/MF $0.75

Performance characteristics of metal-oxygen couples were determined over the range of +125 to −25°F. Evaluation tests were conducted on oxygen electrodes to determine the voltage characteristics over the current density range of 16-800 ma/sq in. Both the silver- and platinum-catalyzed cathodes performed well, with the latter giving about 0.1 volt lower polarization than the former at equivalent current densities. Using the best silver and platinum air electrodes, AlO_2, BaO_2, CaO_2, MgO_2, and ZnO_2 cell systems were examined. For the first four anode metals, most of the investigation was of an exploratory nature. This consisted of a search for electrolytes compatible with both the anode and the cathode. Experimentation with the zinc-oxygen couple in an alkaline electrolyte gave the most favorable results. Flat voltage discharge curves were obtained at rates up to the 2C (800 ma/sq in). At room temperature, an air flow study has been initiated to establish the optimum spacing and venting of adjacent cells. At the 2C rate with a 100 mil. spacing, the free convection of air, resulting from temperature change within the cell, was sufficient to provide the required amount of oxygen to the cathode. Author (TAB)

N66-30603# Rosemount Engineering Co., Minneapolis, Minn.
FLIGHT CALIBRATION OF AIRCRAFT STATIC PRESSURE SYSTEMS
Richard V. De Leo and Floyd W. Hagen Washington, FAA, Feb. 1966 307 p refs
(Contract FA-64-WA-5025)
(SRDS-RD-66-3; REC-76431)

This report describes four methods of static pressure flight calibration: (1) camera fly-over or tower fly-by, (2) pacer aircraft, (3) radar tracking, and (4) trailing probe. The equipment required for each method is listed as well as the accuracy expected and the personnel and flight time required. Complete pre-flight, in-flight, and post-flight procedures and detailed data reduction procedures are described for each method. Data formats are included, as well as suggestions for final data analysis and presentation in correction card form. General background information on the standard atmosphere, altimeters, altimeter errors, and static pressure system errors are included. Author

N66-30881# European Space Vehicle Launcher Development Organization, Paris (France).
SOME CONSIDERATIONS ON ECONOMIC ASPECTS OF THE USE OF RADIO-ISOTOPIC GENERATORS IN SPACE
J. P. Contzen Apr. 1965 17 p
(ELDO-TM-F-18; FP2/ENEA-16) CFSTI: HC $1.00/MF $0.50

Describes a method of assessing the costs of radio-isotopic power supplies used in space. The use of the specific investment in orbit as a factor of economic merit is recommended; after a detailed analysis of this factor an example of calculation in a special case is given. Several radio-isotopic power supplies and solar energy systems are compared from a financial point of view. Author

N66-31113# Monsanto Research Corp., Everett, Mass. Boston Lab.
60-WATT HYDRAZINE–AIR FUEL CELL SYSTEM Interim Report, 1 Jul.–1 Nov. 1965
Peter L. Terry Feb. 1966 51 p
(Contract DA-28-043-AMC-01460(E))
(ECOM-01460-1; MRB402811; AD-629220) CFSTI: HC $5.60/MF $0.50

This report covers the design of the 60-watt hydrazine–air fuel cell system as presented in our Design Plan. Prior to preparation of the Design Plan, a systems analysis of the basic electrochemical system was made. From the results of this analysis, the operating parameters of the support equipment were defined and an initial selection of components made. System components defined were: the cell stack, electrolyte tank, hydrazine feed system, cooling and chemical air blowers, voltage regulator, and thermal control system. A package design was then made for these components and the final detail design completed. Author (TAB)

N66-31225*# Livingston Electronic Corp., Montgomeryville, Pa.
DEVELOPMENT OF HIGH ENERGY DENSITY PRIMARY BATTERIES Third Quarterly Report, 22 Dec. 1965–21 Mar. 1966
S. G. Abens, R. Corbett, and W. C. Merz [1966] 48 p ref
(Contract NAS3-7632)
(NASA-CR-54992) CFSTI: HC $2.00/MF $0.50 CSCL 10C

Studies of the CuF_2–Li system for the development of high energy density primary batteries were conducted. Lithium metal stability in purified PC-$LiClO_4$ electrolyte was studied. Solubility of CuF_2 in PC and BL was found to increase with both water contamination level and $LiClO_4$ concentration. X-ray studies of dried CuF_2 and $CuF_2 \cdot 2H_2O$ showed formation of CuOHF, $CuOHF \cdot CuF_2$ and an unknown compound. Good capacity retention was obtained with CuF_2–Li cells with PC-$LiClO_4$ electrolyte after six weeks wet stand at −15°C. Author

N66-31226*# Monsanto Research Corp., Everett, Mass. Boston Lab.
STUDY OF FUEL CELLS USING STORABLE ROCKET PROPELLANTS Quarterly Report No. 5, 19 Feb.–18 May 1966
R. F. Drake, L. F. Athearn, R. E. Chute, J. C. Orth, and J. O. Smith [1966] 46 p
(Contract NAS3-6476)
(NASA-CR-54988; MRB-5009Q5) CFSTI: HC $2.00/MF $0.50 CSCL 10A

Purification of an impure H_2 product stream from the Aerozine-50 steam reformer by a Pd membrane diffuser has been demonstrated. The diffuser produces ultrapure H_2 at an efficiency of 80%. Scrubbing of unreacted N_2O_4 from the decomposer by water adsorption and subsequent phase separation was simulated and demonstrated. Half cells of 1/3 ft size have been operated on H_2 and O_2. The H_2 half cell polarized less than 0.10 volt at 90 ASF and operated at a coulombic efficiency above 95% on the stream from the Pd membrane diffuser. The O_2 electrode appeared to operate at nearly the same coulombic efficiency. However, it polarized more under load. Operation of the unscrubbed N_2O_4 decomposer stream was attempted, but unstable electrode potentials were found. A highly loaded Pt electrode capable of accepting the CO content of the reformer stream was demonstrated. Author

N66-31357*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF PERFORMANCE OF DOUBLE-REFLECTOR SYSTEM FOR COLLECTING SOLAR ENERGY
Gabriel Kaykaty Washington, NASA, Jul. 1966 29 p
(NASA-TN-D-3534) CFSTI: HC $2.00/MF $0.50 CSCL 10C

A double-reflector system for collecting solar energy was analyzed with regard to its performance to provide an appraisal of its applicability to a solar Brayton cycle power system. The maximum efficiency expected under the most favorable conditions was predicted and compared with that of a collection system consisting of a single paraboloid with the receiver aperture at the focus. The double-reflector collection system employed a paraboloid for a primary reflector, and either an ellipsoid or a hyperboloid for a secondary reflector. The study explored the effects of the primary paraboloidal reflector profile, the secondary reflector profile, the secondary reflector axial displacement, and the receiver aperture position on the collection system efficiency. The surface accuracy of the reflector was represented by an angular error in the plane of the optic axis of 15 minutes maximum on the paraboloid and 6 minutes maximum on the hyperboloid or ellipsoid. The technique for computing the collection system efficiency was to choose a receiver aperture diameter to capture all the energy reflected from the secondary reflector. Author

N66-31367*# Bell Aerosystems Co., Buffalo, N. Y.
STUDY OF DIFFERENTIAL ATTITUDE ENGINE ON-TIME CONTROL TO OBTAIN EXTREMELY LOW LIMIT CYCLE RATES Final Report, 29 Jun. 1965–30 Apr. 1966

Donald C. Neil, John F. Mark, and Robert P. Kaiser Apr. 1966 95 p refs *Its* Rept.-2309-950001 (Contract NAS8-20212) (NASA-CR-76388) CFSTI: HC $3.00/MF $0.75 CSCL 22B

A novel technique for obtaining small net impulse bits is described and evaluated. This differential on-time control (DOTC) technique is based on the concurrent firing of two attitude control thrustors, whose moment contributions in at least one axis tend to cancel, for slightly different lengths of time. Several DOTC concepts are developed for the control of a "base line" space vehicle with roll/yaw thrustors arranged so that each one produces a relatively large control acceleration in roll and a much smaller control acceleration in yaw. The various DOTC concepts are evaluated over a range of key parameters centered about the baseline vehicle and mission characteristics, and compared with linear signal mixing and conventional control concepts on the basis of propellant consumption rates, thrustor actuation rates, and logic complexity. DOTC shows significant performance advantages over the best of other concepts under essentially undisturbed conditions, and provides comparable performance in the presence of the largest environmental disturbances likely to be encountered in orbit. DOTC logic is more complex, and places greater demands on sensor and thrustor performance. However, all component requirements appear to be within the current state of the art. Author

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N66-30022# Lund Univ. (Sweden). Dept. of Zoology.
LOCALIZATION OF MONOAMINERGIC MECHANISMS Final Report
Erik Dahl and Bengt Falck 25 Jan. 1966 32 p refs
(Grant AF-EOAR-64-5)
(AFOSR-66-0711; AD-632127) CFSTI: HC $3.60/MF $0.50

Using the sensitive and specific fluorescence method of Falck and Hillarp in combination with electron microscopy and biochemical methods for the localization and estimation of the monoamines, their immediate precursors, and the pertinent enzymes, monoaminergic nervous mechanisms are studied in a bread comparative material. The fluorescence method has been thoroughly studied both from the chemical and histochemical point of view and is now well standardized. Monoaminergic mechanisms constitute a considerable part of the mollusk nervous system. These mechanisms were studied in both gastopod and bivalve species. Studies of similar type were carried out on annelids and crustaceans and these have disclosed further monoaminergic mechanisms. Some of the monoaminergic system in the upper brain stem in the pigeon have been mapped out. A comprehensive study is performed on the sympathetic innervation of the eye and its adnexa. The dilator muscle of the rat iris was found to contain a hitherto unknown cholinergic ground-lexus. Although the cholinergic receptor is not identified there are reasons for believing that an interaction exists between these two terminal plexus. The monoaminergic mechanisms in the pineal gland are studied in several mammalian species. Monoaminergic mechanisms in the hypothalamo-hypophysical complex are under investigation. In the cod, the existence of short noradrenergic neurons having their cell bodies located peripherally near the effector cells was demonstrated. Author (TAB)

N66-30084*# National Aeronautics and Space Administration, Washington, D. C.
AEROSPACE MEDICINE AND BIOLOGY A Continuing Bibliography with Indexes
Jun. 1966 193 p refs
(NASA-SP-7011(25)) CFSTI: HC $1.00/MF $1.25 CSCL 06S

Abstracts and indexes are compiled for researches dealing with biological, environmental, physiological, and psychological effects to which man is subjected during simulated and actual space flights. References describing similar effects on lower forms of life are included; and attention is given to such related topics as life support systems, safety and survival, and sanitation. While the emphasis is placed on applied research, there are numerous references to theoretical experiments. This is part of a continuing bibliography which includes abstracts of articles previously announced by the American Institute of Aeronautics and Astronautics, the Library of Congress and NASA. M.W.R.

N66-30115*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Advance Biotechnology Dept.
A COMPARATIVE STUDY OF THE PHYSIOLOGICAL EFFECTS OF IMMERSION AND BED REST
P. D. White, J. W. Nyberg, L. M. Finney, and W. J. White Jun. 1966 83 p refs
(Contract NAS9-4166)
(NASA-CR-65414; DAC-59226) CFSTI: HC $3.00/MF $0.75 CSCL 06S

Physiological responses of 10 subjects, each serving as his own control, were compared during alternate 10-day periods of silicone immersion and bed rest. The major findings of this study were: (1) the detrimental effects of prolonged immersion and bed rest on orthostatic tolerance and extracellular fluid were reconfirmed; (2) the incidence of presyncopal reactions on the tilt table was higher and occurred earlier during immersion than during bed rest; (3) during immersion the daily solute load excreted by the kidney, osmolar clearance, and urine output were higher than during bed rest; (4) a negative free-water clearance was seen in all subjects during immersion and bed rest; (5) except for two subjects, the skin problems encountered during immersion were trivial; and (6) the silicone fluid, immersion tanks, filtration, and cooling equipment met the requirements of the experiment. Author

N66-30166# Chicago Univ., Ill.
USAF RADIATION LABORATORY Quarterly Progress Report
15 Jul. 1965 50 p refs
(Contract AF 41(609)-1693)
(QPR-56; AD-619500)

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N66-30167# Chicago Univ., Ill.
PRELIMINARY STUDIES ON THE MECHANISM OF THE RADIOPROTECTIVE EFFECTS OF DIMETHYLSULFOXIDE (DMSO) IN X-IRRADIATED MICE
V. Plzak and J. Doull *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jul. 1965 p 1–13 refs (See N66-30166 17-04)

Preliminary studies were conducted to determine the radioprotective effect of administering dimethylsulfoxide (DMSO) synergistically with other protective agents. Experimental results on mice indicate: (1) The radioprotective effect of DMSO persists at least two hours after administration. (2) The hyperbaric oxygen exposure did not reduce the radioprotective effect of DMSO. (3) In combination with other drugs, an increased number of 30-day survivors was obtained; the enhanced protective effect was qualitatively similar at each of the three X-ray dosage levels used and with each of the three radioprotective agents (p-aminopropiophenone (PAPP), mercaptoethylamine hydrochloride, and 2-aminoethylisothiourea dichloride). In addition, DMSO in combination with PAPP permitted 60 percent of a group of mice given 1200 R of whole-body X-irradiation to survive the 30-day post-irradiation period. R.LI.

N66-30168# Chicago Univ., Ill.
STUDIES ON THE EFFECTS OF VARIOUS DRUGS ON THE ADENOSINE TRIPHOSPHATASE ACTIVITY OF THE HEMATOPOIETIC TISSUES OF RATS EXPOSED TO COBALT-60 GAMMA RADIATION
Robert G. Tardiff and Kenneth P. Du Bois *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jul. 1965 p 14–25 refs (See N66-30166 17-04)

Measurements of the adenosine triphosphatase activity of the hematopoietic tissues of adult female rats exposed to repeated daily doses of cobalt-60 gamma radiation at doses ranging from 45 R to 54 R per day, and the influence of various drugs on the radiation-induced increase in adenosine phosphatase activity were investigated. It was found that a progressive increase in the enzyme activity occurred during the first four days of irradiation after which time continued exposure resulted in a relatively constant, elevated level of activity. A protective effect against this increased enzyme activity was obtained by treating the rats with hydrocortisone, cortisone acetate, progesterone, estradiol, thyroid stimulating hormone, thyroxin, adrenal cortex injection, and adrenocorticotrophic hormone. Mercaptoethylamine, aminoethylisothironium bromide, hydroxylamine, and cysteine also provided protection against spleen injury following irradiation. Similarly, yeast extract, liver extract, liver fractions, and a liver concentrate all exhibited strong radioprotective properties against enzyme changes in the spleen. R.LI.

N66-30169# Chicago Univ., Ill.
THE INHIBITORY EFFECT OF X-RADIATION ON THE DEVELOPMENT OF N-DEMETHYLASTE ACTIVITY IN THE LIVERS OF YOUNG, MALE RATS
Kenneth P. Du Bois and Florence Kinoshita *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jul. 1965 p 26–35 refs (See N66-30166 17-04)

Studies were conducted on the inhibitory effect of X-radiation on the biosynthesis of enzymes located in the microsome fraction of the liver which catalyze the metabolism of steroids and foreign chemicals. A previous measurement procedure was modified to determine the oxidation removal of methyl groups from nitrogen atoms (N-demethylation). This method constituted a valid, quantitative enzyme assay and was somewhat simplified to facilitate analysis. After development of the assay procedure, it was applied to the livers of normal and irradiated rats. It was found that the N-demethylase activity of the livers of normal adult male rats was 4 to 5 times the level in the livers of adult females and weanling males. Weanling male rats (22 days old) were exposed to 400 R and the rate of enzyme development was followed. Comparison of the rate of N-demethylation in the livers of normal and irradiated rats indicated that radiation retarded development of the enzyme system; however, eventually reversal of the effect of radiation was noted. L.E.W.

N66-30170# Chicago Univ., Ill.
FURTHER STUDIES ON THE MECHANISM OF ACTION OF 2-MERCAPTOETHYLAMINE
Kei-Ming Yam and Kenneth P. Du Bois *In its* USAF Radiation Lab. Quart. Progr. Rept. 15 Jul. 1965 p 36–47 refs (See N66-30166 17-04)

Development of a reaction system using rat liver homogenates for studying the metabolism of hexobarbital is discussed; and application of the method for measuring the effect of 2-mercaptoethylamine (MEA) on hexobarbital metabolism is described. The optimal amount of heptane needed for the extraction of hexobarbital from the system was determined by experiments with different amounts of solvent to compare the percent recovery of hexobarbital. To test the optimal concentration of enzyme for the reaction system, the amount of hexobarbital metabolized in a 30-minute period was measured for different levels of whole liver homogenate. Optimal conditions of the co-factors are considered; and the influence of incubation time on metabolism of hexobarbital by the male rat liver is illustrated. A sex difference was observed in the metabolism of hexobarbital in the rat with the adult female exhibiting much lower enzyme activity. Test results showed that at concentrations comparable to the radioprotective dose, MEA produced about 23% inhibition of hexobarbital metabolism. S.P.

N66-30192# Royal Aircraft Establishment, Farnborough (England).
MECHANICAL AND ELECTRODYNAMIC SIMILITUDE IN BIOLOGY
E. Guerra and B. Gunther Mar. 1966 12 p refs Transl. into ENGLISH from Bol. Soc. Biol. (Concepcion) v. 29, 1958 p 87–91
(RAE-LIB-TRANS-1155) CFSTI: HC $1.00/MF $0.50

The theoretical basis of biological similitude is analyzed in relation to the rules of mechanical and electrodynamic similarities. A reduction formula is obtained for biological similarities, whose exponent lies between the values of those

of the physical reduction formulas. Utilizing the equation of biological similarity it has been possible to predict the variations of several physiological functions in relation to body weight. Author

N66-30197# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.

PROBLEMS IN AERIAL APPLICATION: A COMPARISON OF THE EFFECTS OF DIELDRIN POISONING IN COLD-ADAPTED AND ROOM-TEMPERATURE MAMMALS

George Clark Apr. 1966 10 p refs
(AM-66-5)

The effects of dieldrin poisoning on the liver were compared in cold-adapted rats and normal rats. One-fourth of the cold-adapted rats succumbed to the poisoning while all of the normal rats survived. There were minimal fat deposits in both groups, but the cold-adapted rats were least affected. By contrast, cytoplasmic RNA was altered to a greater extent in the cold-adapted rats, although with both the changes were located periportally. Another stain that is probably specific for secondary amines was increased in both treated groups but was decreased in cold adaptation. Author

N66-30198# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.

PHASE SHIFTS OF THE HUMAN CIRCADIAN SYSTEM AND PERFORMANCE DEFICIT DURING THE PERIODS OF TRANSITION. II: WEST–EAST FLIGHT

G. T. Hauty and T. Adams Dec. 1965 18 p refs
(AM-65-29)

At periodic intervals throughout the biological day, biomedical assessments were made for a week prior to jet flight to Rome, for 12 days at Rome, and for a week following return to Oklahoma City. A primary shift of circadian periodicity was manifested by physiological functions—rectal temperature, heart rate, etc. Increase in fatigue occurred during the primary period of transition and following return, but psychological performance was not impaired during either period. Duration of the fatigue was shorter than the time lag of the physiological phase shifts. Author

N66-30209# Battelle-Northwest, Richland, Wash. Biology Dept.

GAMMA RADIATION DOSIMETRY OF ^{137}Cs IN SHEEP EVALUATED WITH THERMOLUMINESCENT DOSIMETERS

C. R. Watson and R. O. Mc Clellan 2 Nov. 1965 16 p refs
(Contracts AT(45-1)-1830; AT(45-1)-1350)
(BNWL-SA-172) CFSTI: HC $1.00/MF $0.50

Lithium fluoride thermoluminescence dosimetry (TLD) was used to measure gamma doses *in vivo* in male sheep ingesting ^{137}Cs. Two commercial TLD systems were found satisfactory for measurements of 500 to 800 mR after a nitrogen purge of the readout chamber was added. Specially fabricated teflon capsules (4mm wall thickness) shielded the LiF from the beta radiation of ^{137}Cs without appreciably attenuating the gamma radiation. Dosimeters were surgically implanted and exposed *in vivo* for 15 days to measure gamma radiation dose rates of 20–60 mrad/day (total dose less than 1 rad) in sheep with body burdens of approximately 300 μC ^{137}Cs. Dosimeters were implanted in another group of sheep prior to feeding of 50 μC ^{237}Cs per day. These animals were killed at intervals to study the accumulation of gamma dose at various organs during a month of ^{137}Cs feeding. Tissue acceptance of the dosimeters was excellent, and dose distribution patterns were similar to those reported earlier. These measurements support NCRP recommendations which assume that designation of the whole body as critical organ will adequately consider the dose to the gonads in the case of a relatively uniformly distributed gamma emitting radionuclide. Author (NSA)

N66-30211# Nuklearni Institut Jozef Stefan, Ljubljana (Yugoslavia).

EFFECT OF LOCAL IRRADIATION ON THE PROTEOLYTIC ACTIVITY OF LEUCOCYTES IN CANCER PATIENTS

M. Kopitar, J. Skrk, L. Savnik, D. Lebez, T. Poniz et al Nov. 1965 12 p refs Submitted for Publication
(NIJS-R-467)

Effects of small, local radiation doses on cathespin activity were studied in leukocytes of cancer patients. The catheptic activity of leukocytes before and after radiotherapy is described. A therapeutic dose of 100 R or 2×150 R gave rise to a considerable increase in the catheptic activity of leukocytes. The differential blood picture and the leukocyte count, as compared with the blood picture of healthy controls, did not change significantly. NSA

N66-30249# Karolinska Institutet, Stockholm (Sweden). Dept. of Physiology.

[DISTRIBUTION OF BIOLOGICALLY ACTIVE COMPOUNDS IN THE BODY] Final Report

U. S. von Euler 31 Mar. 1966 9 p refs
(Grant AF-EDAR-65-52)
(AFOSR-66-0718; AD-632113) CFSTI: HC $1.10/MF $0.50

Abstracts of the following papers are presented: catecholamine depletion and uptake in adrenergic nerve vesicles and in rabbit organs after decaborane; uptake of catecholamines in the rabbit heart after depletion with decaborane; stereospecific catecholamine uptake in rabbit hearts depleted by decaborane; refilling of noradrenaline stores in the prenylamine depleted rabbit heart after injection of octopamine and tyramine; catecholamines in nerve and organ granules; adrenomedullary response to 2-deoxyglucose in the hypothyroid, euthyroid, and hyperthyroid rat; effect of respiratory acidosis on vasoconstrictor effects of directly and indirectly acting sympathomimetic amines in cats; the adrenergic innervation of the vas deferens and the accessory male genital gland; distribution and function of adrenergic nerves in the rabbit fallopian tube; effects of acute heart failure and administration of ouabain on cardiac catecholamine uptake; acceleration of noradrenaline turnover in the mouse heart by cold exposure; and release of cardiac noradrenaline by decaborane in the heart–lung preparation of guinea pig. Author (TAB)

N66-30263# Naval Research Lab., Washington, D. C.

SURFACE CHEMISTRY OF PROTEINS AND POLYPEPTIDES

George I. Loeb 30 Nov. 1965 81 p refs
(NRL-6318; AD-632104) CFSTI: HC $3.00/MF $0.75

The report is a review of recent literature in the field of polypeptide and protein surface chemistry, concentrating on the last decade. Theoretical approaches to polymers at liquid interfaces are considered, and surface measurement techniques are briefly outlined. The various classes of polypeptides are considered, followed by a discussion of proteins in general and specific proteins in particular. Enzymatic activity, structure, and adsorption at various surfaces are considered also. Author (TAB)

N66-30269# Ohio State Univ., Columbus. Human Performance Center.

INFLUENCE OF STRESS VARIABLES ON DISPLAY DESIGN Final Report, Feb. 1965–Jan. 1966

William C. Howell, William A. Johnston, and Irwin L. Goldstein Griffiss AFB, N. Y., RADC, Apr. 1966 47 p refs

(Contract AF 30(602)-3622)

(RADC-TR-66-42; AD-481509)

Nine exploratory studies and five formal experiments were conducted to determine: (1) whether stress decrements occur in a complex display monitoring situation; (2) if so, what variables contribute most to these decrements; and (3) what conditions—particularly display conditions—may be introduced to reduce such decrements. Variables studied include stimulus density; signal frequency, kind, and predictability; irrelevant signal characteristics; display format; duration of monitoring; and response requirements. The major findings suggested that serious stress decrements do occur, but these are not simple monotonic functions over time. Decrements are most severe under conditions of high display density and low signal frequency particularly when predictability of signal occurrence is low and irrelevant information is present. Performance does not seem to deteriorate over weeks or months of daily monitoring sessions. Display formats in which classes of information are separated spatially or in which some spatial compression is introduced seem to reduce decrements and enhance overall performance. Implications of these and other more tentative findings are discussed relative to the problem of display design and future research. Author (TAB)

N66-30283# Naval Air Development Center, Johnsville, Pa. Aviation Medical Acceleration Lab.

PULMONARY FUNCTION IN MAN DURING PROLONGED ACCELERATION. I: DIFFUSING CAPACITY AND BLOOD FLOW

Gordon G. Power, Jr., Richard W. Hyde, Raymond J. Sever, Frederic G. Hoppin, Jr., and Jean R. Nairn (Pa. Univ.) 30 Jun. 1965 22 p refs

(Grant NIH G-H-5430)

(NADC-ML-6512; AD-467142)

This report discusses the possible causes of the decreased arterial oxygen saturation seen when a subject is accelerated in a centrifuge by measuring simultaneously the pulmonary diffusing capacity, and the pulmonary capillary blood flow, using breathholding techniques with carbon monoxide and acetylene. After one minute of forward acceleration at eight times normal gravity, 8G, average capillary diffusing capacity decreased 35% from an initial control of 33.7 to 21.5 ml/min × mm Hg in four subjects. Although this decrease was statistically significant ($p<0.01$) the values observed were not low enough to indicate that impaired diffusion was a prime cause of arterial unsaturation. Average Qc decreased 35% during acceleration from an initial control value of 12.9 to 8.2 l/min, also a significant change ($p<0.01$). These values may have indicated that total pulmonary blood flow was reduced, but a more likely explanation is that a large portion of pulmonary flow perfused non-ventilated regions. Capillary diffusion capacity and Qc returned toward initial control levels within 8 minutes after acceleration in most instances. Author (TAB)

N66-30299*# California Univ., Berkeley. Space Sciences Lab.

OCCURRENCE OF ISOPRENOID ALKANES IN A PRECAMBRIAN SEDIMENT

G. Eglinton, P. M. Scott, T. Belsky, A. L. Burlingame, W. Richter et al 16 Mar. 1965 67 p refs *Its* Ser. No. 6, Issue No. 9 (Grant NsG-101-61)

(NASA-CR-62300) CFSTI: HC $3.00/MF $0.75 CSCL 06A

Alkane fractions derived from a Precambrian sediment and associated oil seepage were studied to supplement information on the origin of terrestrial life. The materials processed were derived from reference samples of tobacco leaf wax, and a Colorado oil shale. Rock samples were crushed into small chips, thoroughly washed with organic solvent, and pulverized into a fine powder. Hot extraction, or ultrasonic extraction with organic solvent, was then performed. Column chromatography over activated alumina, molecular sieve (5 Å) treatment, and gas-liquid chromatography provided the isolation procedures for the individual hydrocarbons, which were identified by retention time on gas-liquid chromatography and by comparison of infrared and mass spectra. It was concluded that isoprenoid hydrocarbons, including farnesane, pristane, and phytane are present in the marker bed of the Precambrian nonesuch shale formation at the White Pine Mine, Michigan, and in the oil seep associated with it. L.E.W.

N66-30308# Joint Publications Research Service, Washington, D. C.

THE EFFECT OF ULTRASOUND AND HIGH-FREQUENCY NOISE ON THE BLOOD SUGAR LEVEL

Z. Z. Ashbel' 29 Jun. 1966 11 p refs Transl. into ENGLISH from Gigiena Truda i Prof. Zabolevaniya (Moscow), no. 2, 1965 p 29–32

(JPRS-36252; TT-66-32685) CFSTI: $1.00

Effects of ultrasonic oscillations and noise transmissions through the air upon blood sugar level were investigated in 40 workers who had been employed at ultrasonic installations for periods of between one and two years. Contact irradiation was considered to have no decisive significance since it was of short duration. Average blood sugar level in persons with empty stomachs subjected to the effects of ultrasonic energy and high frequency noise was found to be 66 mg % after three hours work, whereas level had been 82 mg % before work. On the basis of this study and a perusal of the literature, it is concluded that hypoglecemia observed in workers is caused by the ultrasonic and noise effects produced by the equipment used at work. M.W.R.

N66-30321# School of Aerospace Medicine, Brooks AFB, Tex.

PAROTID FLUID STEROID AND ELECTROLYTE RESPONSES TO EXERCISE Final Report, Apr. 1965

Ira L. Shannon Mar. 1966 12 p refs

(SAM-TR-66-31; AD-632501) CFSTI: HC $1.00/MF $0.50

On 5 successive days, 6 subjects underwent a 10-mile, 2-hour hike to investigate the effects of exercise on parotid fluid flow rate, and levels of free 17-hydroxycorticosteroids, sodium, potassium, and chloride in this secretion. Means for the 5 days for all 6 subjects showed no significant differences in these variables that could be related to exercise. There was, thus, no suggestion of altered adrenocortical function or change in electrolytes that might be expected to accompany such an alteration. Author (TAB)

N66-30341*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

BIOLUMINESCENCE: A SELECTED BIBLIOGRAPHY FROM THE LITERATURE RETRIEVAL SYSTEM, SPACE BIOLOGY BRANCH

Apr. 1966 21 p refs
(NASA-TM-X-55518; X-624-66-152) CFSTI: HC $1.00/MF $0.50 CSCL 06C

This report contains a bibliography on bioluminescence, and includes biochemistry, light measurement, natural growth, and culturing methods for bacteria, fireflies, and other organisms. N.E.N.

N66-30395*# National Aeronautics and Space Administration, Washington, D. C.
PROCEEDINGS OF A CONFERENCE ON THEORETICAL BIOLOGY
George J. Jacobs, ed. 1966 211 p refs Conf. held at Princeton, N. J., 22–24 Nov. 1963
(NASA-SP-104) GPO: HC $1.00; CFSTI: MF $1.25 CSCL 06C

CONTENTS:

1. ON *DE NOVO* CELL SYNTHESIS p 13–138 (See N66-30396 17-04)
2. ASPECTS OF THEORETICAL ECOLOGY R. Levins p 139–174 (See N66-30397 17-04)
3. SYNOPSIS E. C. Pollard p 175–188 ref

N66-30396*# National Aeronautics and Space Administration, Washington, D. C.
ON *DE NOVO* CELL SYNTHESIS
In its Proc. of a Conf. on Theoret. Biol., 1966 p 13–138 (See N66-30395 17-04) GPO: HC $1.00; CFSTI: MF $1.25

The contribution of theory to areas of biological knowledge is discussed, with emphasis focused on conceptual ideas for synthesizing a cell *de novo*. In the round-table discussion, attention centered on the macromolecular aspects; the isolation of the polymerase for DNA and for RNA, and the polymerase for making the peptide bond; and functional structures. A theoretical viewpoint is presented on what should constitute the smallest living cell, or the minimal cell, and some evidence is offered as to what comes closest, experimentally, to this minimum. The specificity and synthesis of organelles is considered, and data obtained from studying yeast mitochondria are discussed. Results are also given on model natural experiments with a precellular model. It was generally concluded that theoretical biology should be concerned first with identifying the functional prerequisites of the minimum living organism, and then determining whether the known cells fulfill these basic functions so that they are not only physically sufficient but physically necessary. M.G.J.

N66-30397*# National Aeronautics and Space Administration, Washington, D. C.
ASPECTS OF THEORETICAL ECOLOGY
R. Levine *In its* Proc. of a Conf. on Theoret. Biol., 1966 p 139–174 (See N66-30395 17-04) GPO: HC $1.00; CFSTI: MF $1.25

Several hypotheses relating to theoretical ecology were presented for roundtable discussion, with population biology defined as an area where three separate disciplines are coming togehter: evolution, population genetics, and population ecology. The question of species interaction is considered, in which it is assumed that competition between species exists at all times. In another approach, the thermodynamic properties of the community are considered, and energy relations studied. This viewpoint holds that many of the dynamics of the population can be determined, not in terms of the biological coefficients that have been identified but in terms of the same physical concepts that can be used in nonliving systems. The analytical difficulties encountered in evolving mathematical models are assessed, and the need for systematically devising a particular class of non-Markov processes for certain problem solutions is pointed out. M.G.J.

N66-30474# Brookhaven National Lab., Upton, N. Y.
HYPERTENSION
Lewis K. Dahl [1963] 16 p refs
(Contract AT(30-2)-GEN-16)
(BNL-8671) CFSTI: HC $1.00/MF $0.50

Evidence is briefly reviewed relating some nutritional elements and hypertension. In rats, hypertension can be produced by chronic excess salt (sodium chloride) consumption; the hypertension so produced can be ameliorated by increasing the dietary potassium or enhanced by other, unidentified, ions. Cadmium, without salt, appears capable of producing hypertension in female rats. In man, the evidence linking salt consumption to hypertension is circumstantial, the most suggestive of which is perhaps the fact that in certain communities with different levels of average salt consumption, the prevalence of hypertension increased, *pari passu*, with the average intake of salt. There is some circumstantial evidence to support the thesis that trace elements may be involved in human hypertension. Author (NSA)

N66-30480# Oak Ridge National Lab., Tenn.
OBSERVATIONS OF VIRAL, CHEMICAL, AND RADIATION-INDUCED MYELOID AND LYMPHOID LEUKEMIAS IN RF MICE
A. C. Upton, V. K. Jenkins, H. E. Walburg, Jr., R. L. Tyndall, and J. W. Conklin [1965] 47 p refs Presented at Intern. Conf. on Murine Leukemia, Philadelphia, 13–15 Oct. 1965 Submitted for Publication
(Contract W-7405-ENG-26)
(ORNL-P-1703; CONF-651038-1) CFSTI: HC $2.00/MF $0.50

Mice of the RF strain treated with ionizing radiation, nitrogen mustard, triethylene melamine, or myleran showed a markedly increased incidence of myeloid leukemia and/or thymic lymphoma, depending on their age, sex, microflora, and physiological state when treated, as well as on the conditions of treatment. Urethane, with or without irradiation, did not affect the incidence of either disease. Myeloid leukemias induced by irradiation were by cell-free extracts. Such extracts also increased the incidence of thymic lymphomas. Lymphomas alone were induced by the Rauscher virus. In general, females were less susceptible to the induction of myeloid leukemia than males, which may be attributable at least in part to the effects of estrogen since this hormone inhibits viral transmission of the disease. Germ-free mice appear less susceptible to the induction of myeloid leukemia by irradiation than their conventionally reared counterparts, but are no less susceptible to induction of thymic lymphomas. These observations indicate that a complex interaction among host factors and extraneous agents determines the incidence, latency, hematologic type, clinicopathologic features, and transmissibility of murine leukemia, at least in mice of the RF strain. Author (NSA)

N66-30488*# Public Health Service, Phoenix, Ariz. Communicable Disease Center.
SERVICES PROVIDED IN SUPPORT OF THE PLANETARY QUARANTINE REQUIREMENTS OF THE NATIONAL AERONAUTICS AND SPACE ADMINISTRATION Quarterly Report, Apr.–Jun. 1966

24 Jun. 1966 41 p *Its* Rept.-14
(NASA Order R-137)
(NASA-CR-76066) CFSTI: HC $2.00/MF $0.50 CSCL 06M

Physical work during the period April through June 1966, at the laboratory for monitoring bacterial contamination of space components consisted of the following efforts: (1) recovery studies of encorporated viable spores of *Bacillus subtilis* var. *niger* from plastics by mechanical methods; (2) the evaluation of ultrasonic methods for removing microbial contamination from artificially contaminated surfaces; (3) the use of coated glass slides for high recovery adhesion of microorganisms; (4) survival tests with spores of *B. subtilis* var. *niger* in an ethanol suspension inoculated on polystyrene granules or suspended in water; (5) comparative studies in microbial contamination levels of operating rooms and industrial clean rooms; (6) the selection of spores from *B. subtilis* from heat shock recovery experiments; and (7) the establishment of a sampling room to monitor spacecraft and electrical equipment microbial contaminations. G.G.

N66-30501# Royal Aircraft Establishment, Farnborough (England).
THE STRENGTH OF BIRDS' WINGS [O PROCHNOSTI KRYL'EV PTITS]
S. N. Shishkin Jan. 1966 33 p refs Transl. into ENGLISH from TSAGI Rept. No. 258, Moscow, 1936
(RAE-LIB-TRANS-1146) CFSTI: HC $2.00/MF $0.50

The problems of the general strength of birds' wings were studied. An original technique has been used for testing the wings of birds of three kinds: a non-swooping non-migratory bird, a non-swooping migratory bird and a swooping non-migratory bird. We have determined the general bending strength of all the wings in the outspread position, and that of one wing in the half-folded position. We have calculated the safe speeds of birds in different flight modes, taking the experimental load factors as a starting point. In certain cases we have found by experiment the lines of the centres of flexure, gravity and pressure of the wings which show that the wing of a bird can act as a model of an 'anti-vibration' wing, and also of a wing which undergoes favorable deformation as the loads are increased. Author

N66-30509# Army Natick Labs., Mass. Food Div.
CALCULATED INTERNAL RADIATION DOSE FROM INGESTION OF MEAT STERILIZED BY ELECTRON IRRADIATION
Thomas G. Martin, III Apr. 1966 22 p refs
(TR-66-26-FD; FD-38; AD-632360) CFSTI: HC $1.00/MF $0.50

The production of radionuclides in food irradiated with high energy electrons can be predicted reasonably well with the equation presented by R. A. Meyer. Using this equation and others derived from the reports of the International Commission on Radiological Protection, it is possible to estimate the amount of radiation received by humans consuming meat irradiated by high energy electrons. The estimated annual internal doses decrease with storage time. At the maximum energy treated the dose would decrease from a maximum of 2.36 mrem/year to a minimum of 0.113 mrem/year with a storage time of 7 days and two years, respectively. The calculated values represented approximately 0.1 to 2% of the average mean radiation exposure of humans, 130 mrem/year due to natural environmental radiation. Author (TAB)

N66-30531*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Advance Biotechnology Dept.
INFLUENCE OF PERIODIC CENTRIFUGATION ON CARDIOVASCULAR FUNCTIONS OF MAN DURING BED REST
P. D. White, J. W. Nyberg, L. M. Finney and W. J. White Jun. 1966 54 p refs
(Contract NAS9-4166)
(NASA-CR-65422; DAC-59286) CFSTI: HC $3.00/MF $0.50 CSCL 06S

A study was made of the influence of periodic centrifugation on the physiological disturbances associated with ten days of bed rest. Subjects rode the centrifuge four times each day; the duration of each ride was 20 minutes; the level of acceleration was +2.5 g_z, referenced to heart level. Major findings of this study were that (1) the prescribed protocol of +2.5 g_z for 20 minutes after 12 hours of bed rest exceeded the tolerance of the subjects to positive acceleration; (2) the model conditioning regimen was +1.75 g_z for 20 minutes four times each day; (3) the expected deterioration produced by recumbency in orthostatic tolerance was alleviated by periodic centrifugation; (4) the conditioning regimen was not quite so effective as shorter g time integrals; (5) step function acceleration tolerance and tolerance for sustained acceleration appear to be a sensitive method for measuring the cardiovascular status; and (7) tolerance to positive acceleration declines after 12 hours of bed rest, remains relatively constant, and rapidly improves during ambulation. Author

N66-30545*# Columbia Univ., New York. Electronics Research Labs.
METHODS FOR DETERMINING BLOOD FLOW THROUGH INTACT VESSELS OF EXPERIMENTAL ANIMALS UNDER CONDITIONS OF GRAVITATIONAL STRESS AND IN EXTRA-TERRESTRIAL SPACE CAPSULES Final Report, 1 Nov. 1960–31 Dec. 1964
R. F. Shaw and A. F. Sciorra 4 Jan. 1965 235 p refs
(Grant NsG-112-61)
(NASA-CR-76205; CU-5-65-NASA-112-ERL; F/168) CFSTI: HC $6.00/MF $1.25 CSCL 06S

The design and development is given of a stable, accurate electromagnetic blood flowmeter to determine blood flow through intact vessels of experimental animals under conditions of gravitational stress and in extraterrestrial space capsules. The flowmeter is operated by a voltage induced in a conductor when it moves in a magnetic field. In this device, the moving conductor is blood and an electromagnet produces the field. Connections to the blood are provided indirectly through the blood vessel walls by electrodes which are an integral part of the magnet support structure. Details are given on receiver and artifact problems, compensation techniques, implementation of a compensated system, amplification of composite signal, timing and demodulating, flow-signal processing, flowmeter operating modes, power supply system, and generation of the magnetic field. Although the device was not chronically implanted in an animal, it was demonstrated with one of the preliminary models that the techniques devised to obviate the effects of artifact signals, which have adversely affected other flowmeters, did work. Some difficulty was experienced with the probe magnet driver circuit, and a better design was indicated. L.E.W.

N66-30550# Defence Research Board, Ottawa (Ontario). Directorate of Scientific Information Services.
DATA ON COMPARATIVE MORPHOLOGY OF EXTERNAL EYE MUSCLE RECEPTORS IN VERTEBRATES

D. V. Burnasheva Mar. 1966 13 p refs Transl. into ENGLISH from Cesk. Morfol. (Czechoslovakia), v. 11, no. 1, 1963 p 57–67
(T-450-R; AD-632027) CFSTI: HC $1.00/MF $0.50

Data are given concerning only sensory nerve endings of external eye muscle receptors. TAB

N66-30558# Navy Medical Neuropsychiatric Research Unit, San Diego, Calif.
SELECTION FOR ANTARCTIC SERVICE Interim Report
E. K. Eric Gunderson Mar. 1966 22 p refs
(Rept.-66-15; AD-632497) CFSTI: HC $1.00/MF $0.50

Environmental conditions, group composition, and work roles at Antarctic scientific stations are described, and possible sources and effects of stress in these environments are indicated. Cultural and psychological characteristics of various Navy and civilian occupational groups represented in wintering-over parties are compared, and the selection problem and procedures are outlined. Personal history, clinical, and self description variables which correlated significantly with three performance criteria are presented for Navy enlisted and 'seabee' groups, providing a summary of characteristics that distinguish the successful Navy man at small Antarctic stations. Author (TAB)

N66-30576# Massachusetts Univ., Amherst.
INHIBITION OF THE SYNTHESIS OF MACROMOLECULES BY ULTRAVIOLET RADIATIONS Progress Report
Paul A. Swenson [1965] 5 p refs
(Contract AT(30-1)-3511)
(TID-22352) CFSTI: HC $1.00/MF $0.50

It is proposed that the inhibition of β-galactosidase formation in cells irradiated prior to induction is the result of gene inactivation, by dimers acting as blocks to the synthesis of messenger RNA. The results of experiments on the effects of uv irradiation on bacterial cells showed this to be the case. NSA

N66-30585# Oak Ridge National Lab., Tenn.
BIOLOGY DIVISION Semiannual Progress Report for Period Ending 31 July 1965
Nov. 1965 222 p refs
(Contract W-7405-ENG-26)
(ORNL-3853) CFSTI: HC $6.00/MF $1.25

Reports are presented on biological research in the following areas: chromosome cytology, fungal genetics, drosophila cytology and genetics, and cytochemistry; cell reproduction, growth, and differentiation; subcellular and viral physiology; radiation microbiology and immunology; mammalian genetics, cytogenetics, and recovery; chemical protection and enzyme catalysis; nucleic acid enzymology and chemistry; biophysics, biochemistry, pathology; plant physiology and photosynthesis; space biology; and NIH–AEC cooperative projects. N.E.N.

N66-30586*# California Univ., Los Angeles. Dept. of Physiology.
NON-PHOSPHORYLATING RESPIRATION OF MITOCHONDRIA FROM BROWN ADIPOSE TISSUE OF RATS
Robert E. Smith, Jane C. Roberts, and Karl J. Hittelman [1966] 13 p refs Submitted for Publication
(Grants NsG-721; PHS-G-HD-01826)
(NASA-CR-76215) CFSTI: HC $1.00/MF $0.50 CSCL 06C

Mitochondria from brown adipose tissue of cold-acclimated rats (6°C) oxidize α-ketoglutarate at a rate twice that of controls (26°C). In both groups, however, the P/O ratio with α-ketoglutarate has never exceeded unity, and is essentially zero with either succinate or α-glycerophosphate. ATPase activity of these mitochondria is very low and is not stimulated by 2,4-dinitrophenol (DNP). Additionally, both respiration and phosphorylation are unaffected by ADP, DNP, bovine serum albumen or glutathione. Endogenous respiration of tissue slices is not stimulated by DNP. It is suggested that brown fat mitochondria are not capable of oxidative phosphorylation, but do phosphorylate at the substrate level. As these findings provide an unusual example of electron transport via an energetically non-conservative pathway, their significance to thermogenesis by brown adipose tissue is particularly emphasized. Author

N66-30613*# California Univ., Los Angeles. School of Medicine.
PERINEAL ABSCESS SECONDARY TO GAS GANGRENE: USE OF HYPERBARIC OXYGEN AS A THERAPEUTIC ADJUNCT IN A CASE
A. T. K. Cockett and C. Steven Hatch [1966] 10 p
(Grant NsG-237-62)
(NASA-CR-76242) CFSTI: HC $1.00/MF $0.50 CSCL 06E

Hyperbaric oxygen is used in treating a perineal abscess in a 71-year old male with an acute lower urinary tract difficulty associated with a swollen tender mass in the perineum. On the second evening following incision and drainage of the abscess, the patient became acutely ill with gas gangrene which was later shown to be due to Clostridium Welchii. Initial treatment consisted of polyvalent gas gangrene antitoxin, Chloramphenicol, streptomycin, and penicillin in therapeutic concentrations. The following morning he was treated with hyperbaric oxygen of two atmospheres over a 17-hour period. Long-term follow-up reveals no significant complications. M.W.R.

N66-30616*# Stanford Univ., Calif. Dept. of Biochemistry.
STRUCTURE AND FUNCTION OF PROTEINS AND NUCLEIC ACIDS Semiannual Progress Report, 1 Jan.–30 Jun. 1966
Arthur Kornberg and Lubert Stryer [1966] 12 p refs
(Grant NGR-05-020-137)
(NASA-CR-76222) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Potential applications to planetary explorations are considered for research techniques and findings related to the structure and function of proteins and nucleic acids. Nanosecond fluorimetry as a complement to spectral resolutions, selective fluorescent labeling reagents for the detection of macromolecules, and enzymatic synthesis of genetically active DNA are discussed. Progress is also reported in investigations dealing with the use of homopolymer templates to facilitate replication of transforming factor, excited state proton transfer reactions, a conformational change accompanying the activation of an enzyme from *Escherichia coli*, and X-ray crystallographic studies of the alpha-subunit of tryptophan synthetase. M.W.R.

N66-30618# Joint Publications Research Service, Washington, D. C.
RESULTS OF PHYSIOLOGICAL AND BIOCHEMICAL EXAMINATIONS OF MEMBERS OF THE VOSKHOD SPACESHIP CREW

I. S. Balakhovskiy, P. V. Vasil'yev, I. I. Kas'yan, and I. G. Popov 28 Jun. 1966 21 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 2, Mar.–Apr. 1966 p 212–220
(JPRS-36227; TT-66-32660) CFSTI: $1.00

Cardiovascular and metabolic responses of the cosmonauts aboard the Voshkod spacecraft are reviewed. Although both crew members tolerated well the 24-hour orbital flight and no significant impairment in their overall health was noted, signs of stress and general fatigue as well as physiological changes were noted which disappeared between three and four days after the flight. Both telemetry measurements and clinical investigations by the cosmonaut-physician are reported. It is noted that cardiac and respiratory rates did not increase as much during this joint flight as during solo flights. Actual descent was found to be more uncomfortable than the effect of acceleration experienced in a centrifuge. M.W.R.

N66-30623# Public Health Service, Washington, D. C. National Center for Health Statistics.
WEIGHT, HEIGHT, AND SELECTED BODY DIMENSIONS OF ADULTS—UNITED STATES, 1960–1962
Howard W. Stoudt, Albert Damon, Ross Mc Farland (Harvard School of Public Health), and Jean Roberts Jun. 1965 55 p refs
(Publ.-1000, Ser. 11, No. 8)

Selected measurements of physique are presented for adults between the ages of 18 and 79 in the civilian, noninstitutional population. Based on findings obtained during the first cycle of the 1960–62 Health Examination Survey, 90% of the men were found to weigh between 126 and 217 lb, with an average of 168 lb. Weight decreased with age from the maximum average of 172 for those 35 to 54 yr old to 150 lb for the 75 to 79 group. Comparable figures for women were 104 to 199 pounds, with an average of 142 lb. Maximum average, 152 lb, is found in the 55 to 64 group; and average weight drops to 138 for the 75 to 79 group. Average height of men is 68.2 in. and for women it is 63.0 in. Data are also given for sitting, knee, elbow rest, and thigh clearance heights; as well as length of upper part of the leg and elbow-to-elbow breadth. Discussed are differences in racial and ethnic groups, socioeconomic levels, and between civilians and military personnel. Numerous tables are included. M.W.R.

N66-30633# Midwest Research Inst., Kansas City, Mo.
A STUDY OF THE MICROBIOLOGY OF SELECTED DEHYDRATED FOOD PRODUCTS Final Report, 15 Oct. 1963–15 Apr. 1965
F. E. Wells Natick, Mass., Army Natick Labs., May 1966 55 p refs
(Contract DA-19-129-AMC-206(N))
(TR-66-35-FD; FD-49; AD-633390) CFSTI: HC $3.00/MF $0.50

The effect of freeze-drying on the viability of six species of bacteria on seven kinds of food is presented. Freeze-drying influences are presented and discussed in relation to the effects of freezing, drying and storage conditions. The influence of food type and physiological age of bacteria is shown to influence both immediate losses in viability as well as the rate at which such losses occur during storage. The rate of decline in bacterial viability during storage is discussed as a function of the degree of metabolic injury sustained by the bacteria during the freeze-drying process. Author (TAB)

N66-30640# Archer-Daniels-Midland Co., Minneapolis, Minn.
EDIBLE COATINGS FOR DRIED AND COMPACTED FOODS, PART I Final Report
Morton S. Cole Natick, Mass., Army Natick Labs., Apr. 1966 109 p refs
(Contract DA-19-129-AMC-102(N))
(TR-66-37-FD; FD-47; AD-633044) CFSTI: HC $4.00/MF $0.75

Studies are presented on the development of edible barrier materials, their application to dehydrated foods and evaluation under accelerated storage conditions, effects of atmospheric oxygen and moisture, fragmentation and abrasion, and attack by microorganisms. The most effective coating materials include hot melts of acetoglycerides and ethylcellulose; mixtures of monoglycerides and polyglycolesters; protein films including soy proteinate and gelatin; fatty esters of amylose; monoglycerides; hard fats; and combinations of these materials in the form of laminates or mixtures. Approved chemical preservatives, including sorbic acid, potassium sorbate, methyl and propyl p-hydroxybenzoates, were effective in retarding mold growth when incorporated in coating formulations. Author (TAB)

N66-30655# Cincinnati Univ., Ohio.
THE EFFECTS OF SIMILARITY AND REPETITION OF RESPONSE ALTERNATIVES ON VARIOUS TYPES OF PAIRED ASSOCIATE LEARNING Final Report
K. A. Johnson (AMRL), R. J. Senter, and F. W. Smith Wright-Patterson AFB, Ohio, AMRL, Dec. 1965 25 p refs
(Contract AF 33(615)-1046)
(AMRL-TR-65-214; AD-633059) CFSTI: HC $1.00/MF $0.50

The investigation was an attempt to find learning materials for which the simultaneous presentation technique would be inferior to other techniques. Subjects learned a 40-item list of paired-associates under one of four training conditions. The stimulus terms were the names of electronic circuits, the response terms, schematic diagrams of electronic circuits. Half the items had distractors that were very similar to the correct response term, the remaining half, distractors that were less similar. Half the items in each of these groups had distractors that were the correct response terms for other items in the list. The remaining items had distractors that were unique to a given item. The overall differences between training techniques were not large, but there was some indication that the five alternative prompt condition was inferior to the remaining conditions. Interactions were found between training conditions and item types, but again the differences involved were not large. Separate comparisons on the various item types indicated that in no case was the one alternative prompt condition reliably inferior to any of the remaining conditions. Author (TAB)

N66-30658# North American Aviation, Inc., Downey, Calif. Life Sciences Dept.
EFFECTS OF COLD EXPOSURE UPON THE ACTION OF THERAPEUTIC DRUGS, PART II Second Report, Nov. 1964–Nov. 1965
James Y. P. Chen and H. C. Bergman Ft. Wainwright, Alaska, Arctic Aeromedical Lab., Apr. 1966 24 p refs
(Contract AF 41(604)-2683)
(SID-65-1626; AAL-TR-66-3; AD-633347) CFSTI: HC $1.00/MF $0.50

In rats acutely exposed to cold as compared to room-temperature, the toxic responses to parenteral injections

of meperidine hydrochloride, of dextroamphetamine sulfate and prochlorperazine ethanesulfonate were invariably greater in cold than at room temperature. With further experiments an even greater increase was noted in the acute oral toxicity of prochlorperazine dimaleate at 4°C; the acute oral toxicity of this drug was 144 times greater at 4°C than at room temperature. This large difference in toxicity appeared to be an additive effect of the inherent hypothermic action of the drug and of the temperature-lowering action in the cold enviroment. Tests with larger animals, monkeys and dogs, indicated that the differences in toxicity between the room temperature and cold environments were not as great as in rats. The ability of large animals to retain body heat in the cold for a longer time than rats may have contributed to the lesser effect. The results with monkeys injected with prochlorperazine in increasing dosage may have revealed the possibility of a tolerance development to the drug. Author (TAB)

N66-30671# School of Aerospace Medicine, Brooks AFB, Tex.

CAPILLARY DEVELOPMENT DURING EXPOSURE TO CHRONIC HYPOXIA, 1 JANUARY–30 JUNE 1965

S. Cassin, R. D. Gilbert, and E. M. Johnson Feb. 1966 12 p refs

(Contract AF 41(609)-2421)

(SAM-TR-66-16; AD-633091) CFSTI: HC $1.00/MF $0.50

A group of 18 male rats weighing initially 110 to 131 gm. was exposed to a pressure altitude of 20,000 feet for 36 days in a decompression chamber. A similar group of 18 male rats was maintained at sea level for a like period. Hematocrits and organ-to-body-weight ratios were measured for heart, testes, adrenals, and kidneys in all animals at the end of the period. Capillary counts in heart, gracilis, and psoas muscles were made by utilizing a specific stain for endothelial cells. The hematocrit ratio and all measured organ-to-body-weight ratios increased significantly in the chronically hypoxic rats. A significant increase in capillary counts was also found in these animals. On the basis of these preliminary studies, it would appear that in chronic hypoxia, there is an increase in vascularity due to an increase in capillary number rather than an increased patency of existing vessels Author

N66-30680# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

POST-FLIGHT CHEST DISCOMFORT IN AVIATORS: AERO-ATELECTASIS

Elihu York 30 Dec. 1965 13 p refs

(NADC-MR-6516; AD-632752) CFSTI: HC $1.00/MF $0.50

Three jet pilots recently flew high G bank maneuvers, while breathing 100% oxygen and wearing anti-G harnesses, as part of an in-flight project for weapons systems development. As a consequence, on more than one occasion, all three pilots experienced shortness of breath, cough, and aching in the chest. This latter symptom persisted as long as 3 hours following flight. Physical examination was unremarkable. A pulmonary function study revealed a reduction in vital capacity, immediately following flight, of 20–28% as compared to pre-flight levels outside the plane. A partial, reversible collapse of lung tissue 'aero-atelectasis' may be the mechanism for the observed finding, which could conceivably contribute to aircraft accidents, if not modified. Author (TAB)

N66-30693*# Aerospace Medical Div. Aeromedical Research Lab. (6571st), Holloman AFB, N. Mex.

QUANTITATIVE EFFECTS OF ABRUPT DECELERATION ON PULMONARY DIFFUSION IN MAN Technical Report, 1 Sep. 1965–1 Feb. 1966

Alan C. Whitehouse, William K. Brown, Peter Foster, and Harris F. Scherer May 1966 20 p refs

(NASA Order T-13335G)

(NASA-CR-76375; ARL-TR-66-12; AD-633170) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Pulmonary diffusion capacity was measured in nine subjects using the steady state method to determine if this physiological measurement was altered by impact. Each subject rode the Daisy Decelerator twice backward ($+G_x$) at 25 g, twice laterally ($-G_y$) at 15 g, and experienced one sham ride. Carbon monoxide diffusion capacities were measured immediately before and after each ride, and 3 and 24 hours afterward. No significant change in pulmonary diffusion capacity was associated with impact. There was no correlation between observed and predicted CO diffusion capacity based on oxygen consumption, however, observed CO diffusion capacity and oxygen consumption were highly correlated. The validity of the prediction formula as described by Donevan et al, is questioned, but this may be related to the increased altitude (4400 ft) at which the studies were done. Author (TAB)

N66-30694# FMC Corp., Santa Clara, Calif.

INVESTIGATION OF DRYING PROCEDURES FOR COMPACTED FOODS Final Report, 18 Mar. 1964–17 May 1965

L. F. Ginette Natick, Mass., Army Natick Labs., May 1966 68 p refs

(Contract DA-19-129-AMC-228(N))

(TR-66-34-FD; FD-46; AD-633267) CFSTI: HC $3.00/MF $0.75

Compressed food bars representing protein, carbohydrate and fat in all proportions likely to be encountered with natural products and adjusted to 15–25 percent moisture were dried in a forced draft air drier under controlled conditions to a residual moisture content below 5 percent. Rates of drying were studied in relation to wet and dry bulb temperatures of the air flow, composition of bars, shape of bars, and pressure of compression. Observations were performed to identify the effect of the drying regimen on surface texture, density, migration of fat and soluble components, and organoleptic properties. Conditions for a practical air drying process were defined. Author (TAB)

N66-30696# School of Aerospace Medicine, Brooks AFB, Tex.

EFFECTS OF PREDNISOLONE AND TRIAMCINOLONE ON CORTICOSTEROID LEVELS IN PAROTID FLUID, SERUM, AND URINE Technical Report, Jun. 1965–Jan. 1966

Robert L. Jenson and Ira L. Shannon Mar. 1966 15 p refs

(SAM-TR-66-24; AD-633119) CFSTI: HC $1.00/MF $0.50

A simultaneous determination was made of 17-OHCS in serum, urine, and parotid fluid, by the Porter–Silber reaction, after the oral administration of prednisolone, triamcinolone, or placebo to 240 normal human subjects. The data clearly demonstrate the homology of serum and parotid fluid 17-OHCS levels through a range of 0.22 micrograms to 57.72 micrograms/100 ml. In serum, urinary excretion of steroids was highest following prednisolone, intermediate in the placebo group, and lowest after triamcinolone dosage. Author (TAB)

N66-30702# School of Aerospace Medicine, Brooks AFB, Tex.
EFFECTS OF HYDRAZINE ON BLOOD GLUCOSE AND MUSCLE AND LIVER GLYCOGEN IN THE ANESTHETIZED DOG Progress Report, Mar.–Nov. 1964
Gale D. Taylor (M.S. Thesis—Texas A&M Univ.) Mar. 1966 16 p refs
(SAM-TR-66-13; AD-633164) CFSTI: HC $1.00/MF $0.50

Intravenous injection of diluted hydrazine (25 mg./kg.) into anesthetized dogs caused prompt elevation of blood glucose levels, which reached a maximum in about 2 hours and decreased progressively during 4 hours thereafter. Liver glycogen levels fell rapidly during the first 4 hours after injection of hydrazine. Depletion of liver glycogen stores was associated with severe hypoglycemia and some depletion of muscle glycogen. Packed cell volume progressively increased after hydrazine administration. Microscopic examination of liver tissue from treated dogs showed swelling of hepatic cells and apparent fatty infiltration. Sections of liver stained with PAS confirmed the rapid glycogen depletion. It is postulated that hydrazine affects the carbohydrate concentration of various tissues by a primary insult to the glycogenetic-glycogenolytic mechanism of the liver. Author (TAB)

N66-30707# Naval Air Development Center, Johnsville, Pa.
HUMAN BIOCHEMICAL PARAMETERS OF ACCELERATIVE STRESS Final Report
Elihu York, Nicholas J. Colosi, and John H. Roediger 13 Apr. 1966 20 p refs
(NADC-MR-6603; AD-632817) CFSTI: HC $1.00/MF $0.50

Acceleration stress conditions were imposed on four healthy subjects riding the human centrifuge. Blood biochemical analyses were performed on all subjects, with the demonstration of an increase in blood glucose following centrifugation in three of the four subjects, two of whom developed blackout. All four subjects developed greyout. The changes in blood sugar may suggest a relationship between epinephrine secretion and graduated acceleration stress resulting in physiological changes in the subject. Changes in pooled plasma phospholipid fractions were demonstrated in blood samples obtained before and following acceleration; these changes suggest that acceleration may interfere with intracellular energy transfer mechanisms involving phosphorylated compounds associated with oxidative metabolism. The preliminary results of the pilot project indicate that further biochemical measurements may be desirable in assessing acceleration tolerance in man. Author (TAB)

N66-30746*# Naval School of Aviation Medicine, Pensacola, Fla. Naval Aerospace Medical Inst.
A STANDARD TECHNIQUE FOR TEMPORAL BONE PREPARATION Joint Report
Makoto Igarashi 2 Mar. 1966 52 p refs *Its* Monograph-13 (NASA Order R-93)
(NASA-CR-76281) CFSTI: HC $3.00/MF $0.50 CSCL 06P

The inner ear end organs are structurally fragile with the membranous labyrinth weakly supported within the bony labyrinth. The technique of histological preparation must be directed toward preserving the anatomical relationship of the inner ear structures and minimizing post-mortem changes. The densely ossified petrous portion of the temporal bone must be decalcified and the inner ear spaces uniformly infiltrated with celloidin, all the while maintaining the histological integrity of the membranous labyrinth. This monograph is intended as a guide in the preparation of good temporal bone slides which will make it possible to investigate the correlation between end organ functions and morphological findings. No fundamental histological information is included, however, as that appears in other publications. The techniques described herein have been found to render the most consistently satisfactory temporal bone preparation. Author

N66-30749*# Technology, Inc., Dayton, Ohio.
INVESTIGATION OF STRENGTH OF ISOLATED VERTEBRAE Quarterly Report, 30 Jan.–29 May 1966
Jeremy F. Crocker and Lawrence S. Higgins [1966] 21 p refs (Contract NASw-1313)
(NASA-CR-76296; TI-1313-66-2) CFSTI: HC $1.00/MF $0.50 CSCL 06E

Progress is reported in the continuing research to study the strength of human vertebrae under various conditions of static and dynamic loads. The preparation of specimen is described, and a transducer, which was developed to correlate the pressure of the nucleus pulposus with deflection of the annulus fibrosus, is discussed. Additionally, comments are made on a literature search that was conducted to define an approximate value for the strength of the human vertebrae. H.S.W.

N66-30755*# Stanford Univ., Calif. Dept. of Genetics.
DETECTION OF OPTICAL ACTIVITY AS A SIGN OF LIFE
John W. Westley Apr. 1966 14 p refs (Grant NsG-81)
(NASA-CR-76301; IRL-1047) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Living organisms work against the law of increasing disorder and concentrate order within themselves. One of the most fundamental aspects of this order is the optical purity of those metabolites which are built up into polymers and as a consequence of this, biological processes usually exhibit steric discrimination. Gas liquid chromatographic (G.L.C.) procedures have been developed whereby important metabolites such as amino acids can be scanned for optical activity with very high sensitivity. By using a combination of G.L.C. and mass spectrometry we have found a method of ratio-detection as well as identification of optically active compounds. More recently we have observed that within 24 hours of inoculating non-sterile soil with a racemic mixture of certain substrates, marked changes in the D:L ratio of the unused substrate can be detected. Author

N66-30763*# Naval School of Aviation Medicine, Pensacola, Fla.
THE THOUSAND AVIATOR STUDY: SMOKING HISTORY CORRELATES OF SELECTED PHYSIOLOGICAL, BIOCHEMICAL, AND ANTHROPOMETRIC MEASURES Joint Report
Norman E. Lane, Albert Oberman, Robert E. Mitchell, and Ashton Graybiel 27 Apr. 1966 20 p refs (NASA Order R-136)
(NASA-CR-76264; NAMI-961) CFSTI: HC $1.00/MF $0.50 CSCL 06N

During the 1963 follow-up examination in the Pensacola Thousand Aviator Study, smoking history information was obtained by questionnaire of 675 subjects. Concurrent data were collected from clinical examinations, laboratory tests, anthropometry, and personal history variables. Two smoking variables were created, cigarette amount (CA) and cigarette years (CY), each on a scale of 1 to 5 points. From the concurrent data, 62 variables were selected for relevance and

general interest to be examined in relation to smoking. Twenty-four of the 62 variables had significant correlations ($p<.05$) with CA, and 16 showed significant relationships to CY. Findings are related briefly to previous research, and problems of cause–effect isolation are mentioned. It is concluded that results in general support previous findings on smoker–nonsmoker differences. Contributions of the study in delineating areas of research for longitudinal investigation are discussed. Author

N66-30764*# Republic Aviation Corp., Farmingdale, N. Y.
STUDY OF THE FECAL BACTERIAL POPULATION OF CHIMPANZEES Final Report, Oct. 1964–Dec. 1965
Phyllis E. Riely May 1966 230 p refs
(NASA Order R-25; Contract AF 29(600)-499)
(NASA-CR-76265; ARL-TR-66-13) CFSTI: HC $6.00/MF $1.25 CSCL 06C

Cultures isolated from rectal swabs obtained from 100 chimpanzees and two fecal samples from five chimpanzee handlers were studied. The data obtained from the aerobic bacterial studies were summarized in tables grouping the occurrence of the enterobacteriaces, streptococcus, and miscellaneous aerobes so that comparisons could be made with the results obtained on two prior studies. The data of the occurrence of the anaerobic bacterial cultures were summarized in tables as obligate or facultative anaerobes, using the same method of grouping the cultures as in prior studies. Differences in the anaerobic character of chimpanzees and human fecal populations was noted—the percentage of obligate anaerobes exceeding 90% for the human cultures, and ranging between 26% and 71% for the chimpanzee cultures. A literature survey was conducted to aid in the evaluation of the potential pathogenicity of bacterial strains isolated from the chimpanzee. A remarkable similarity exists in the aerobic flora of primates, although differences in the pathogenicity of particular species of bacteria for various primate hosts have been reported in the literature. Carrier states are prevalent in the chimpanzee. The anaerobic fecal population of the chimpanzee differs from man. Author

N66-30766*# Naval School of Aviation Medicine, Pensacola, Fla.
BIOCHEMICAL CHANGES OCCURRING WITH ADAPTATION TO ACCELERATIVE FORCES DURING ROTATION
James K. Colehour and Ashton Graybiel 25 Apr. 1966 16 p refs
(NASA Order R-93)
(NASA-CR-76289; NAMI-959) CFSTI: HC $1.00/MF $0.50 CSCL 06S

Four young men lived in a continually rotating room, 15 feet in diameter, for a period of six days. Rotational velocities on succeeding days were: 6.4, 6.4, 8.6, 10.0, 6.4, and 3.2 RPM. Stress effects measured as increased excretion rates of 17,21 dihydroxypregnane-20-ones, eosinopenia, hyperventilation, and nausea were observed on the first day of rotation. However, adaptation was rapid, and no further stress effects were observed even with increased rotational velocity. Mild degrees of hypercalciuria, hypercapnia, and decreased norepinephrine excretion rates were observed during the last four days of the experiment as a result of the increased time spent in recumbency. Author

N66-30785*# Naval School of Aviation Medicine, Pensacola, Fla.
A NOTE ON THE DOSIMETRIC INTERPRETATION OF RIGIDITY SPECTRA FOR SOLAR PARTICLE BEAMS
Hermann J. Schaefer 26 Apr. 1966 20 p refs Joint Rept. with NASA
(NASA Order R-75)
(NASA-CR-76283; NAMI-960) CFSTI: HC $1.00/MF $0.50 CSCL 06R

Three flux/rigidity spectra are established theoretically covering the full variability range of all flare events of the past solar cycle and are evaluated dosimetrically. It is found that, of the components heavier than protons, only alpha particles contribute substantially to total exposure. The fractional alpha dose in the tissue surface behind 0.1 g/cm^2 shielding grows from 40 percent for P_0=50 Mv to 400 per cent for P_0=300 Mv. The alpha dose shows a much steeper drop with increasing depth than the proton dose and would require microsensors for accurate measurement. For the alpha and medium heavy components, the relative biological effectiveness (RBE) shows a pronounced transition in near surface regions which further steepens the drop of RBE dose equivalents as compared to rad doses. The extremely strong and nonlinear dependence of the rad and rem dose distribution on rigidity sharply limits the usefulness of the rigidity concept for dosimetric evaluations and indicates the need for direct measurements of local rad and rem doses on the astronaut's body. Author

N66-30789*# National Aeronautics and Space Administration, Washington, D. C.
OXYGEN UTILIZATION OF THE ORGANISM AND ITS REGULATION
N. A. Agadzhanyan et al Jun. 1966 205 p refs Transl. into ENGLISH of "Kislorodnyy Rezhim Organizma i Yego Regulirovaniye", (Kiev) Kiyevskaya Knizhnaya Tipografiya, 1965 Abstracts of papers presented at a symp. held in Kiev-Kanev, 24–29 May 1965
(NASA-TT-F-420) CFSTI: HC $5.00/MF $1.25 CSCL 06P

A collection of excerpts from papers on the oxygen metabolism in mammals, under conditions of hypoxia, includes topics on: effect of induced hypoxia in trained and untrained human subjects; oxygen utilization control by regulatory mechanisms; psychological and biochemical aspects of altitude hypoxia; and biological oxidation. Some conclusions based on results of animal and human experiments, readings of cardiograms, electroencephalograms, pneumotachometry, etc., comprise: Systematic training, up to hypoxia, during postnatal ontogenesis decreased the oxygen (energy) consumption and respiratory rate. Animals kept at partial vacuum (180 mm Hg) with body temperature artificially maintained at normal level showed a high mortality rate, proving the protective effect of the natural hypothermia induced by hypoxia. Encephalograms indicated that the cerebral cortex is most affected by hypoxia. The upper limit of partial oxygen pressure for prolonged inhalation is placed at 3 atm. abs. Suggested measures for improvement in body function include increase in ionized oxygen content of inspired air in enclosed space; active physical training under high-mountain conditions; rational breathing exercises in the altitude chamber; addition of CO_2 to the respiratory air during hyperventilation to increase the oxygen uptake of the brain; etc. Author

N66-30791*# Texas Christian Univ., Fort Worth.
THE EFFECTS OF STRESS ON SMALL GROUP PERFORMANCE
Fred E. Fiedler 8 Dec. 1965 33 p refs
(Grant NGR-44-009-008)
(NASA-CR-76333) CFSTI: HC $2.00/MF $0.50 CSCL 05J

The results are presented of a study on the effects of stress on leadership and group performance. The study consisted of two phases: one dealt with the contribution which the leader and the members of a group make in performing a task under varying conditions of stress, while the other concerned the type of leadership style which is most appropriate to group performance. R.N.A.

N66-30795*# California Univ., Berkeley. Dept. of Nutritional Sciences.
NUTRITIONAL REQUIREMENTS AND BREEDING BEHAVIOR OF PEROGNATHUS Semiannual Progress Report, 1 Jan.–30 Jun. 1966
[1966] 6 p ref
(Grant NGR-05-003-118)
(NASA-CR-76327) CFSTI: HC $1.00/MF $0.50 CSCL 06B

During this period a number of nutritional supplements were tested in an effort to induce and maintain estrus in *Perognathus*. The attempts were unsuccessful and are possibly due to the maintenance of an unfavorable photoperiod. Purina mouse breeder chow and a fully synthetic diet were found to maintain weight in a group of *P. Baileys*. A simple apparatus was assembled for use in estimating oxygen consumption and therefore caloric requirement. R.N.A.

N66-30798*# Texas Christian Univ., Fort Worth.
A MODEL FOR THE SOCIAL SYSTEM FOR THE MULTIMAN EXTENDED DURATION SPACE SHIP
S. B. Sells [1965] 12 p refs
(Grant NGR-44-009-008)
(NASA-CR-76330) CFSTI: HC $1.00/MF $0.50 CSCL 05E

The conditions of isolation, confinement, and other stresses to which extended duration space crews will be exposed are unprecedented and many of the problems are not yet understood. Hypotheses directed toward principles to optimize crew organization and adaptation must be generated from present knowledge. Extrapolations might be attempted from various literature sources of human experience in extreme situations. However, the appropriateness of such generalization depends on the system similarity of the various situational contexts to that of the spaceship. A model social system for such microsocieties was constructed and system profiles of eleven well known system patterns were compared with that postulated for the extended duration spaceship. Greatest similarity was found for submarines, exploration parties, naval ships and bomber crews, and least for shipwrecks and disasters, industrial work groups, and prison groups. Author

N66-30821# Brookhaven National Lab., Upton, N. Y. Biology Dept.
RELATIVE BIOLOGICAL EFFECTIVENESS OF DIFFERENT TYPES OF IONIZING RADIATIONS: CYTOGENETIC EFFECTS IN MAIZE
Harold H. Smith [1965] 4 p refs Presented at Symp. on Mutational Process, Prague
(Contract AT(30-2)-GEN-16)
(BNL-9383; CONF-650814-1) CFSTI: HC $1.00/MF $0.50

The frequency of yg_2 events in leaves grown from irradiated Yg_2/yg_2 maize seeds shows a linear response to dose. Compared with 250 kVp X-rays, the approximate relative biological effectiveness (RBE) of monoenergetic neutrons (0.43 to 14.7 MeV) is between 50 and 100, of muons (7 BeV) 0.76, of π^- mesons (8 BeV) 3.2, and of protons (28 BeV) 4.4. These results were considered in terms of dose average linear energy transfer (LET) and whether or not nuclear interactions take place. Application of microdosimetric concepts to this system indicates that the interphase chromosome is broken, to cause a yg_2 event, when a charged particle delivers an energy of approximately 90 keV to a spherical region of the cell nucleus that is approximately 1 micron in diameter but proportional to nuclear size. Author (NSA)

N66-30887# Weizmann Inst. of Science, Rehovoth (Israel).
THE APPLICATION OF CLONED HAEMOPOIETIC CELLS IN RADIATION PROTECTION Progress Report No. 4, 1964-1965
Michael Feldman [1965] 6 p refs
(Contract AT(30-1)-3173)
(TID-22503) CFSTI: HC $1.00/MF $0.50

Experiments were carried out to test the effects of transfusion-induced polycythemia on the formation and differentiation of cell-specific clones. Polycythemic and uninjected, X-irradiated mice were inoculated with 1, 2, or 5×10^4 bone marrow cells from syngeneic donors. The polycythemic animals showed a 3-fold decrease in the total number of macroscopic nodules as compared to normal X-irradiated recipients. The polycythemic animals showed a complete suppression of erythroid clones. It was concluded that polycythemia appears to specifically suppress the formation of erythroid clones. It was also found that oxygen is a necessary, although it may not be a sufficient, factor in preventing erythroid clone formation. NSA

N66-30962# Institut d'Embryologie Experimentale, Nogent-sur-Marne (France).
STUDY OF RADIATION EFFECTS ON THE EMBRYO AND ITS ORGANS IN VIVO AND IN VITRO [ETUDE DE L'EFFET DES RAYONNEMENTS SUR L'EMBRYON ET SES ORGANES IN VIVO ET IN VITRO] Research Report, 1 Oct. 1964–30 Sep. 1965
Brussels, EURATOM, [1965] 14 p refs In FRENCH
(Contract EURATOM-039-64-10 BIOF)
(EUR-2643-f)

The effects of X-rays on germ-cells, the migratory power of these cells, and DNA synthesis in geonocytes in chickens were studied by means of labelling with tritiated thymidine. The effects of X-rays on the physiology and respiratory metabolism of the chick embryo intestine and heart was investigated extensively. Certain biochemical effects of X-rays on coenzyme I and its glycohydrolase are reported. The mode of action of chemical and radioprotective agents, such as cysteamine, was studied in an embryonic organ cultivated *in vitro*. Certain early radiation lesions were detected by electron microscopy. The radiosensitivity of the natural inductor in amphibians was measured, as also was the teratogenesis action of radiomimetic substances such as nitrogenated mustard gas. Irradiation experiments were carried out on cancerous nodules cultivated *in vitro* and a number of regeneration problems were solved with the aid of X-irradiations. Author (NSA)

N66-30963# Louvain Univ. (Belgium). Laboratoire de Cytogenetique.
EFFECTS OF MICRO-IRRADIATIONS OF CHROMOSOME SEGMENTS. MORPHOLOGICAL, BIOCHEMICAL AND GENETIC CONSEQUENCES [EFFETS DES MICRO-IRRADIATIONS DE SEGMENTS CHROMOSOMIQUES. CONSEQUENCES MORPHOLOGIQUES, BIOCHIMIQUES ET GENETIQUES] Final Report

Brussels, EURATOM [1965] 44 p In FRENCH
(Contract EURATOM-001-61-7 BIOB)
(EUR-2518-f)

The experimental procedures are described that were developed for the micro irradiation of chromosomes with ultra-violet, X-rays, and alpha particles. Results obtained in studies on the effects of radiation on chromosomes in developing pollen grains in culture are reported. NSA

N66-30964# North Texas State Univ., Denton. Dept. of Biology.

OXYGEN UPTAKE IN RAT BRAIN TISSUES X-IRRADIATED IN VITRO

James R. Lott and John F. Hines [1965] 24 p refs Presented at the 13th Ann. Meeting of the Radiation Res. Soc., Philadelphia
(Contract AT(40-1)-3270)
(CONF-650560-17)

The changes in oxygen uptake in various brain tissues in rats X-irradiated *in vitro* was determined manometrically. The specific areas studied were: the cerebral cortex, the thalamus, mid-brain, and pons-medulla. The doses of X-irradiation used were 10 and 20 kR. The important findings were that the Qo_2 values of isolated brain tissues show a decreasing metabolic gradient from cortex to brain stem that can be altered with X-irradiation; respiration of the cortex and pons-medullary tissues were inhibited during the second hour post-irradiation following 20 kR, whereas, the thalamic and mid-brain tissue slices exhibited little change to these doses; and the changes observed occurred in the absence of circulating humoral agents indicating a localized effect of the ionizing radiation. The results were discussed in terms of changes in biochemical integrity, permeability, and on the basis of differences in cellular morphology of the tissues studied. NSA

N66-30965# Rochester Univ., N. Y. Dept. of Radiation Biology.

BIOCHEMICAL ASPECTS OF RADIATION INJURY AND RECOVERY

Sol M. Michaelson, Charles R. Angel, Kent T. Woodward, and Joe W. Howland [1965] 9 p Presented at the 13th Ann. Meeting of the Radiation Res. Soc., Philadelphia
(Contract AT(30-1)-1286)
(CONF-650560-15) CFSTI: HC $1.00/MF $0.50

Principles of physiology and biochemistry were utilized in studies to assess late manifestations of ionizing radiation. Biochemical indices among beagles that survived whole- and partial-body exposure to 1 MeV X-rays were correlated for comparison of relative sensitivities of vital processes in various portions of the animal's body. Altered biochemical activity in relation to diminished physiologic reserve capacity are of significance in delineating radiation injury and repair processes and the animal's ability to respond to superimposed and interposed stresses. Author (NSA)

N66-30977# Sloan-Kettering Inst. for Cancer Research, New York.

BIOLOGICAL AND CLINICAL DOSIMETRY Annual Progress Report, Jul. 1, 1964–Jun. 30, 1965

John S. Laughlin 6 Jul. 1965 80 p
(Contract AT(30-1)-3510)
(NYO-3510-14) CFSTI: HC $3.00/MF $0.75

During the period of this report local dose microcalorimeter previously described was employed to examine the depth-dose distribution produced in carbon by high energy electrons. Cavity ionization measurements were made in the same geometry and corrected to dose in rads with and without the polarization correction. It is significant that at large depths where the electron energy was low the absolute values of dose obtained by these two methods agree. At lesser depths the polarization correction was required to bring the two methods into approximate agreement. The significance of some remaining discrepancy at higher energies is being further investigated. An intercomparison of the dose produced by high energy electron beams as measured at different institutions was instituted. Both the lithium fluoride thermoluminescent dosimeter and the Fricke ferrous sulphate dosimeter have been under extensive development with respect to different methods of packaging for mailing, procedures for optimum reproducibility, etc. A significant difference between the dose in rads as measured by lithium fluoride luminescence and by the Fricke ferrous sulphate dosimeter between cobalt-60 gamma rays and high energy electrons was discovered. The significance of this unexpected dependence of lithium fluoride thermoluminescence on radiation quality is being investigated. Measurements of the dose produced by the electrons from a high intensity source (600 kev field emission generator) have been initiated. Doses of the order of megarads delivered in 30 nanoseconds have been measured with cellophane dye and thermoluminescent methods. A calorimeter is being designed to carry out these measurements on a more absolute basis. The investigation of solid state detectors uncovered a temperature dependence. A further effect involving a change in current output from the detectors under prolonged irradiation was found to be associated with the effects of ionized air on the surface of the devices. Irradiation in vacuum eliminated this. NSA

N66-31[illegible]63# Oak Ridge National Lab., Tenn.

EFFECTS OF UV-IRRADIATION ON MACROMOLECULAR SYNTHESIS IN *ESCHERICHIA COLI*

P. A. Swenson and R. B. Setlow 1965 42 p refs
(Contract W-7405-ENG-26)
(ORNL-P-1331) CFSTI: HC $2.00/MF $0.50

Several sensitive and resistant strains of *E. coli* B were examined for some of the factors that influence the inhibition of DNA synthesis by uv irradiation and some factors related to the repair of uv lesions. The quantitative analysis of the inhibition of DNA synthesis is described in terms of a model in which a pyrimidine dimer acts as a complete block to DNA synthesis. Effects of uv irradiation on RNA and protein synthesis in radiation resistant and sensitive strains are shown. Author (NSA)

N66-31077# California Univ., Berkeley. Lawrence Radiation Lab.

COMBINED EFFECT OF SPACE-FLIGHT FACTORS ON CERTAIN FUNCTIONS OF AN ORGANISM [KOMBINIROVANNOYE VOZDEYSTVIYE FACTOROV KOSMICHESKOGO POLETA NEKOTORYYE FUNKTSII ORGANIZMA]

G. M. Frank, N. N. Livshits, M. A. Arsen Eva, Z. I. Apanasenko, L. A. Belyaeva et al 1965 82 p refs Transl. into ENGLISH of Acad. of Med. Sci. of the USSR Preprint No. 17 Presented at 2nd Intern. Symp. on Basic Environ. Probl. of Man in Space, Paris, 14–18 Jun. 1965
(UCRL-TRANS-1232; CONF-650668-3) CFSTI: HC $3.00/MF $0.75

The results of studies on the effects of space flight conditions, including acceleration, vibration, ionizing radiation, and combinations thereof, on physiological functions, oxidizing metabolism in the central nervous system, and cell division in hematopoietic tissues in guinea pigs, mice, rabbits, and rats exposed to simulated conditions on the ground and during the flight of satellites, led to the conclusion that the different physiological changes that occur under the influence of acceleration or vibration result in a number of disturbances of cell division and that this in turn can alter the radiation effect. The diversity and complexity of a combined exposure to dynamic factors and irradiation are discussed. Author (NSA)

N66-31084# Oak Ridge National Lab., Tenn.
RELATIVE BIOLOGICAL EFFECTIVENESS OF BETA DOSES ON THE SKIN COMPARED TO GAMMA DOSES ON THE WHOLE BODY, IN THE CASE OF CONTAMINATION OF THE TERRAIN, ON ONE HAND, AND IN THE CASE OF CONTAMINATION OF CLOTHING, ON THE OTHER
S. Pretre Apr. 1965 11 p Transl. into ENGLISH from Bull. ABC No. 7 (France)
(ORNL-TR-969)

The relative biological effectiveness of β particles on the skin and whole-body γ radiation were compared. The terrain was assumed to be uniformly contaminated by a mixture of fission products such as that found after a nuclear explosion. Using the criteria presented, it was concluded that β particles from the terrain were of approximately one order of magnitude smaller than the γ radiation from the terrain; the β dose from clothing uniformly contaminated by a mixture of fission products was approximately one order of magnitude greater than the γ radiation from the clothing; and the radiation dose due to clothing was of the same order of biological effectiveness as that due to the terrain. NSA

N66-31090# Oak Ridge National Lab., Tenn.
PHOTOPRODUCTS IN IRRADIATED BACTERIAL SPORES: NO THYMINE DIMERS
J. E. Donnellan, Jr. and R. B. Setlow [1965] 9 p refs
(Contract W-7405-ENG-26)
(ORNL-P-1113) CFSTI: HC $1.00/MF $0.50

B. megaterium spores labeled with tritiated thymidine were irradiated with monochromatic ultraviolet light and the spore DNA analyzed for thymine containing photoproducts. No thymine dimers were observed, but large amounts of new thymine photoproducts were found. The unknown photoprudct was produced *in vitro* by irradiation of DNA dried in the presence of various salts. NSA

N66-31162*# Teledyne Systems Corp., Hawthorne, Calif.
ELECTRICAL RESISTANCE OF THE SKIN
2 Nov. 1964 28 p refs Prepared for Spacelabs, Inc.
(Contract NAS4-566)
(NASA-CR-57212) CFSTI: HC $2.00/MF $0.50 CSCL 06P

The function and structure of the skin is reviewed, and the primary sources of skin resistance are identified as the stratum lucidum and stratum corneum. Examples are given to show that different subjects can yield differing skin resistance measurements; the factors causing these variations are listed as size and type of electrode, bodily area measured, temperature of this area, whether the external current passing through the subject is ac or dc, the size of this current, and whether it remains constant or varies with the change of resistance. The relationship between sweat glands and skin resistance is also considered. Based on these data, models of skin impedance are constructed, and a schematic of a pair of single mesh biogrids and the associated skin resistances is presented. The figure indicates that the electrical path from the source to the subcutaneous layer is a short circuit. The vertical resistors have their lower ends shorted together in each biogrid square, and represent the path from the skin's surface to the subcutaneous tissues. It is assumed that the subcutaneous tissue has negligible resistance in comparison to the resistance of the stratum corneum and stratum lucidum. M.G.J.

N66-31221*# Franklin Inst., Philadelphia, Pa. Research Labs.
EFFECTS OF REPRODUCIBLE MAGNETIC FIELDS ON THE GROWTH OF CELLS IN CULTURE Final Report, May 1, 1965–Apr. 30, 1966
M. H. Halpern [1966] 31 p
(Contract NSR-39-005-020)
(NASA-CR-75121; Q-B2375-4) CFSTI: HC $2.00/MF $0.50 CSCL 06F

The combined results are presented of experiments on a series of plant and animal specimens which were exposed to magnetic fields varying in intensity from near zero (less than one milligauss) to higher than ambient (1100 oersteds maximum). Test conditions and environmental parameters are summarized. For the near-zero magnetic fields, tabulated data are presented on the growth of Euglena, Chlorella, Colpidium, Paramecium Caudatum, and Paramecium Multimicronucleatum. Experiments were also conducted to determine the effect of a magnetically field-free environment on white clover and wheat seed germination; the findings are tabulated. The effect of exposure to magnetic fields greater than ambient, as compared to controls, is also summarized. It was concluded that the general effect seems to be one of growth acceleration in the very low field; in the higher than ambient fields, growth inhibition is indicated. M.G.J.

N66-31234*# Woods Hole Oceanographic Institution, Mass.
DATA FILE ON AMINO ACID DISTRIBUTION IN CALCIFIED AND UNCALCIFIED TISSUES OF SHELL-FORMING ORGANISMS
Egon T. Degens and Derek W. Spencer Jun. 1966 250 p *Its* Reference No. 66-27
(Grants NSR-22-014-001; PRF-1943-A2)
(NASA-CR-76381) CFSTI: HC $6.00/MF $1.50 CSCL 06A

Information is presented, for the study of calcification in biological systems, on: (1) type, locality, and environment of sample organism; (2) analytical techniques; (3) digital computer utilization; and (4) quantitative amino acid analysis (tabulated results). A series of mollusks and a few other shell-secreting invertebrates were investigated. The selection of specimens was made purely on biological grounds so as to cover a wide phylogenetic range from ancestral to derived, i.e., primitive to highly evolved, forms. Moreover, an attempt was made to incorporate a certain number of marine specimens coming from habitats characterized by water temperatures of −2° to +40°C, salinities from 10 to 80%, and water depth from 1/2 meter to about 100 meters. The primary objective of the study was to show the

significance of the shell-protein variation to the environment and molluscan phylogeny. In addition, the amino acid composition of the mantle, the periostracum, and the ligament was determined for a number of specimens to gain more insight into factors governing the calcification of the shell organic matrix. D.T.

N66-31306# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DRUGS FOR RADIATION PROTECTION
L. A. Tiunov, G. A. Vasil'yev, and E. A. Val'dshteyn 17 Feb. 1966 587 p refs Transl. into ENGLISH of the book "Protivoluchevyye Sredstva" Moscow, Izd. Nauka, 1964 318 p
(FTD-TT-65-556/1+2; TT-66-61282; AD-633268) CFSTI: HC $8.85/MF $2.50

The reference book contains data on more than 1000 preparations described up to 1963. Data published in 'Protivoluchevyye Sredstva.' (drugs for radiation protection, pub. 1961), are not repeated. Bibliographical data are compiled at the end of the book; references are listed alphabetically and numbered. The efficiency of the protection (sensibilization) is expressed by the factor of dose variation of the radiation dose administrated to the subject to be protected in order to achieve the same effect as on irradiation without protection. The structural formulas are given in the form represented by the authors of the references. Structual formulas and synonyma of preparations described in the reference book of 1961 are not given. Because of the great influence of the oxygen effect on the action of drugs for radiation protection, the composition of the gaseous medium during the irradiation is given whenever possible. Absence of such data means that the irradiation was carried out in air. Apart from new preparations, the most important data published before 1961 are mentioned if they were not described previously for some reason. TAB

N66-31314# Army Foreign Science and Technology Center, Washington, D. C.
PLASTICS AND SYNTHETIC POLYMERS IN MEDICAL MICROBIOLOGY
V. N. Tarasov May 1966 13 p refs Transl. into ENGLISH from Zh. Mikrobiol. Epidemiol. i Immunobiol. (Moscow), no. 12, 1965 p 121-126 Presented at All-Union Conf. on the Uses of Polymers in Med. and Med. Ind., Leningrad, 29 Oct. 1964
(FSTC-HT-23-85-66; AD-633208) CFSTI: HC $1.00/MF $0.50

A survey of the published literature on the utilization of plastics and other polymeric materials in microbiology and virology is presented. Emphasis is placed on the use of polystyrene, polymethylmethacrylate, polyamides, polyethylene and other plastics and synthetic polymers as materials for growing cell, tissue and virus cultures, performing serological investigations, freezing tissues and cells, and producing antibacterial and antiviral preparations. Author (TAB)

N66-31335# Indiana Univ., Bloomington.
PHYSIOLOGICAL AND SUBJECTIVE ADAPTATION TO SHOCK: A DISCREPANCY
Robert M. Stern and Larry Gaupp May 1966 12 p refs
(Contract Nonr-908(15))
(TR-12; AD-632893) CFSTI: HC $1.00/MF $0.50

The purpose of the experiment was to compare subjective and physiological adaptation to 15 repeated electric shocks of the same intensity. Twenty-four subjects received shocks at the highest level they would tolerate. Twenty-four others received shocks at their predetermined annoying level. All subjects were told that shock intensity would vary from trial to trial and that their task was to rate the intensity of each shock. The data for both groups show that there was no physiological adaptation, as determined by size of GSRS, but there was significant subjective adaptation. The results are accounted for in terms of special qualities of the stimulus electric shock. Author (TAB)

N66-31381*# Union Carbide Research Inst., Tarrytown, N. Y.
THE GENERAL AND COMPARATIVE BIOLOGY OF TERRESTRIAL ORGANISMS UNDER EXPERIMENTAL STRESS CONDITIONS Semiannual Report
S. M. Siegel 1 May 1966 78 p ref
(Contract NASw-767)
(NASA-CR-76409; UCRI-383) CFSTI: HC $3.00/MF $0.75
CSCL 06M

To correct the statement that ultraviolet light on Mars would prevent existence of any earth-type life, various terrestrial organisms were tested under ultraviolet fluxes of 400,000,000 Erg-cm $^{-2}$ or more. Animal species, vascular plants, and other forms of terrestrial life subject to experimental stress conditions are discussed, as well as the relationship between ultraviolet radiation and oxygen. The germination of allium and the growth of a variety of organisms in ammonia-rich environments is described. Unlike NH_3, which supported the germination of about 75% of 30 varieties and allowed only 10% germination at most, 0.01 M Na or KOH at the same pH (12) permitted at least minimal germination in all varieties. Germination in the 50% to 80% range was fairly commonplace in the alkalies and green shoots. A review of preliminary experiments is presented for the microbiology of ultra-saline, acidic, and other extreme chemical environments. Lymphocytes are used to demonstrate that membrane-monitored stress responses lead to increases in white cell number in a discussion on the relation of permeability to environmental stress. S.P.

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N66-30012# RAND Corp., Santa Monica, Calif.
TEMPORAL FACTORS IN SUBJECTIVE COLOR
Joseph J. Sheppard, Jr. Mar. 1966 43 p refs
(Contract ARPA SD-79; ARPA Order 189-61)
(RM-4770-ARPA; AD-631874) CFSTI: HC $2.00/MF $0.50

The memorandum provides a synopsis of what is known about subjective-color sensations produced by temporal factors in the retinal luminous stimulus. Four principal psychophysical phenomena or effects involved in subjective color are identified and discussed. The Prevost-Fechner-Benham effect refers essentially to the evocation of a color sensation that differs when the visual stimuli are presented intermittently

rather than continuously. The Broca–Sulzer–Pieron effect concerns the variations of color sensations with time. The Brucke–Bartley effect refers to the enhanced brightness of visual stimuli when presented intermittently rather than continuously. The disappearance of visual sensation when the retinal image is artificially stabilized so that it falls continuously on the same receptors is termed the Ditchburn–Ratliff effect. The use of the Prevost–Fechner–Benham effect to obtain colored images on black-and-white television receivers is discussed to illustrate one technological application of subjective color. An unexpected appearance of the Prevost–Fechner–Benham effect in a visual experiment is discussed to emphasize the dangers involved in a failure to consider subjective-color effects during the design of man–machine systems utilizing human visual characteristics.

Author (TAB)

N66-30026# RAND Corp., Santa Monica, Calif.

A CRITICAL REVIEW OF THE EXPERIMENTAL FOUNDATION OF HUMAN COLOR PERCEPTION

Joseph J. Sheppard, Jr. Jan. 1966 199 p refs

(Contract ARPA SD-79; ARPA Order 189-61)

(RM-4196-ARPA; AD-630316) CFSTI: HC $5.00/MF $1.00

A presentation of the minimum material needed for a comprehensive study of normal human color perception. The artificial nature of colorimetry is discussed, with emphasis on the distinction between experimental facts established in the matching experiments and the formalism of colorimetry derived in part from these facts. A representative portion of the available experimental data on individual foveal spectral sensitivity is collected and analyzed. Data on the initial photoreception process and the anatomy, histology, morphology, ontogeny, and electrophysiology of the retinal neutrons are analyzed, noting the multiplicity of results indicating a fundamental difference between receptor mechanisms in the rods and cones. A review of data on central neural mechanisms indicates a complex, dynamic role for the lateral geniculate nuclei in human color vision. Considerations of diverse psychophysiological phenomena are summarized. The general conclusion of the study is that the available experimental evidence does not clearly dictate the fundamental physiological processes mediating human color vision. Principal conclusions are discussed in relation to the three distinct fields of colorimetry, visual biophysics, and visual psychophysics. Four suggestions are given for psychophysical modeling.

Author (TAB)

N66-30388*# St. Louis Univ., Mo.

THE ROLE OF THE SOCIAL PHILOSOPHER IN THE SPACE AGE

Robert J. Henle *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 155–157 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

New communications capabilities—encompassing telephones, computer storage of knowledge, printouts, television across the world, etc.,—will make human participation in actual events as they occur possible, and at the same time give future generations a relationship with the past that will almost approach a living participation. Human values should be used to manage and manipulate these new technologies to insure the future welfare and happiness of all mankind. G.G.

N66-30390*# Massachusetts Inst. of Tech., Cambridge. Dept. of Astronautics and Aeronautics.

CREATIVITY, EDUCATION, AND SPACE EXPLORATION

C. S. Draper *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 190–193 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The new technology of space travel together with new knowledge becoming available from observations made from space stations, greatly affects advanced education. New areas of learning are thus developed and students are motivated to follow academic careers through to completion. The challenges of space exploration and the opportunities associated with its accomplishments develop creativity in talented individuals and lead to innovations and benefits for the human society. G.G.

N66-30391*# Yale Univ., New Haven, Conn.

THE SOCIAL CONSEQUENCES OF THE SPACE AGE

Harold D. Lasswell *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 194–199 refs (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The potential significance of the Space Age on the legal, governmental, and political order of all mankind is explored. Social consequences and potentialities of the coming conquest of space will require cultural as well as biological adaptation. Future research policies will propose prototypes and pilot projects to initiate and study space communities of distinct social compositions and of contrasting political, economic, familial, and other institutions. Continuing surveys of the social consequences of space throughout the world community should be designed to describe changes in both perspective and overt behavior. G.G.

N66-30444# Federal Aviation Agency, Oklahoma City, Okla. Office of Aviation Medicine.

EFFECTS OF DECOMPRESSION ON OPERATOR PERFORMANCE

William F. O'Connor and George E. Pendergrass Apr. 1966 18 p refs

(AM-66-10)

This study was performed to provide more quantitative estimates of degradation of pilot performance following decompression and the extent to which a decompression with mask donning interrupts the task of piloting. The experiments utilized a Scow complex coordinator and were conducted in an altitude chamber. Subjects were decompressed to altitudes from 25,000 to 41,000 feet. Results indicate impairment of performance for 2 to 4 minutes following rapid decompression. Total time loss from mask donning is much more extended than the 5 to 6 seconds required to don the mask.

Author

N66-30512# TRACOR, Inc., Austin, Tex.

A PERFORMANCE-ORIENTED APPROACH TO DETECTION: TABLES FOR DETECTION, DISCRIMINATION, AND DECISION THEORY

Anne Blocker Blosser 17 Nov. 1965 76 p refs

(Contract NObsr-93140)

(TRACOR-65-267-U; AD-622085)

The possible outcomes of a yes–no signal detection task are outlined, and the relationships among the dependent variables, such as detectability, percent correct performance, and criterion are discussed. A performance oriented approach to detection is considered, and it is pointed out that while two observers may have the same detectability index for a given signal-to-noise ratio, their criteria may differ radically. The percent correct performance of an observer using two different criteria for several a priori probabilities

of signal values is shown. Based on these comparisons, tables were constructed to facilitate data analysis of results from signal detection experiments. These tables list the criteria values and maximum possible percent correct performance, as a function of detectability and of the relationship between signal probability and the costs and values associated with each possible outcome of the experiment. The computer programs used in constructing the tables are included. S.P.

N66-30532*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Advance Biotechnology Dept.

THE EFFECTS OF CENTRIFUGE RADIUS ON THE PERFORMANCE OF ENTRY TASKS

W. C. Middleton and W. J. White Jun. 1966 32 p refs
(Contract NAS9-4166)
(NASA-CR-65421; DAC-59274) CFSTI: HC $3.00/MF $0.50
CSCL 05H

Representative entry tasks were performed by 10 subjects under static conditions, and also during exposure to an Apollo entry profile produced at centrifuge radii of 64 in. and 178 in. Performance of a discrete response task and a tracking task decreased between 4% and 22% on the moving centrifuge as compared with performance on the static centrifuge, and it decreased between 12% and 22% on the short as compared with the long-radius centrifuge. Changes of this magnitude are considered to be sufficiently small that they would not invalidate the onboard centrifuge as a testing or training device. Positive transfer of training was obtained in going from a short- to a long-radius centrifuge, but negative transfer was obtained in going from the long- to short-radius centrifuge.
Author

N66-30617*# Martin Co., Denver, Colo. Aerospace Div.

HUMAN ENGINEERING DATA AND CONCEPTS FOR HANDLING ADVANCED NUCLEAR SYSTEMS IN SPACE Research and Technology Implications Report

Jul. 1965 29 p
(Contract NAS8-11425)
(NASA-CR-78149; CR-65-89) CFSTI: HC $2.00/MF $0.50
CSCL 05E

Problem areas are described which were uncovered during a study of systems and equipment for a large orbital research laboratory, the Manned Orbital Research Laboratory, and interplanetary and lunar ferry vehicles. Design data for nuclear space systems, radiation criteria for space operations, maintenance and repair concepts, space suit development, and remote handling operations are discussed. Other problem areas considered are the development of remote maneuvering units and space logistics vehicles, nuclear propulsion vehicle abort, and criteria for removal and packaging of used reactors. The relationship of man to a reactor-type SNAP (System for Nuclear Auxiliary Power) system is discussed, as is advanced program planning. M.W.R.

N66-30697# MITRE Corp., Bedford, Mass.

STUDIES IN DISPLAY SYMBOL LEGIBILITY. PART VIII: LEGIBILITY OF COMMON FIVE-LETTER WORDS

Gary Kosmider, Marion Young, and Glen Kinney Bedford, Mass., AFSC, Electron. Systems Div., May 1966 16 p refs
(Contract AF 19(628)-5165)
(TM-4239; ESD-TR-65-385; AD-633055) CFSTI: HC $1.00/MF $0.50

The report describes the findings of a study in symbol legibility which investigated the reading time and errors for common five-letter words when they are projected by a solid stroke and when they are shown by a broken stroke. The latter was produced on a 945-line TV monitor at 10, 7, and 5 active lines per symbol height. With visual size, brightness, contrast, and other viewing conditions controlled, the best reading performance resulted from solid-stroke letters. Broken-stroke letters constructed by resolution of 10, 7, and 5 lines resulted in progressively poorer performances. TAB

N66-30704# California Univ., Los Angeles. Dept. of Engineering.

UPPER EXTREMITY PROSTHETICS RESEARCH, HUMAN TRACKING, SENSORY MOTOR CONTROL, MYOELECTRIC CONTROL Progress Report, 15 Jan.–15 Apr. 1966

John Lyman 15 Apr. 1966 20 p refs
(Contracts V1005P-9779; N125(60530)32857A; AF 33(615)-1969; Grant VRA-RD-120IN-64)
(Rept.-66-28; AD-633250) CFSTI: HC $1.00/MF $0.50

Contents: Upper extremity prosthetics research: experimental investigation of the Heidelberg pneumatic arm; experimental investigation of the Northwestern attitudinal controlled elbow; experimental investigation of the French electric hand; exploration of minor surgical methods for developing new body control sites; exploration of new harnessing techniques for transducers; evaluation of tentative design criteria for externally powered prostheses. Research on sensory motor control: experimental investigations of the AIPR pneumatic arm; experimental investigations of functional muscle isolation by training; development of an external logic system for prosthetic motion control. Research on the performance of human operators of tracking system: function generator; reports; experimentation. Research on myoelectric control systems: unidimensional EMG control to a self-paced input; unidimensional EMG control to a step input. TAB

N66-30714# University Coll., London (England). Phonetics Lab.

[PHONETICS LABORATORY] PROGRESS REPORT

A. J. Fourcin, ed. Sep. 1965 75 p refs
(Contract AF 61(052)-692)
(AFCRL-66-169; AD-633350) CFSTI: HC $3.00/MF $0.75

Contents: Duration and spectral form as cues in the recognition of English and German vowels; perception of time intervals; pitch mediation by temporal mechanisms; experiments with delayed auditory feedback; formants in Vietnamese vowels of different tones; measurement of trans-glottal impedance; fricative synthesis with an acoustic model; spectral analysis; direct random recording of synthetic speech stimuli; automatic audiometer; dependence of stress judgments on vowel formant structure. TAB

N66-30731# Applied Psychological Services, Wayne, Pa. Science Center.

STUDIES INTO INFORMATION PRESENTATION THROUGH NOVEL METHODS: INFORMATION TRANSFER THROUGH ELECTROCUTANEOUS STIMULATION

Arthur I. Siegal, Richard S. Lanterman, and Douglas H. MacPherson Apr. 1966 98 p refs
(Contract DA-28-043-AMC-00186(E))
(ECOM-00186-7; AD-632735) CFSTI: HC $3.00/MF $0.75

International Morse code reception, one dimensional-tracking, and probabilistic decision making with electrocutaneous signals were investigated. It was found that trained Morse operators can receive electrocutaneously presented

Morse code after only brief training. After as much as 19 to 22 hours of electrocutaneous Morse reception training, the operators' performance with electrocutaneous signals had not reached their performance levels with auditory signals. No difference was found between electrocutaneous and visual, one-dimensional tracking or between probabilistic decision making with the two modes of reception. Author (TAB)

N66-30732# Naval School of Aviation Medicine, Pensacola, Fla.

COMPARISON OF THREE EXERCISE DEVICES FOR THE ELECTROCARDIOGRAPHIC STRESS TEST

Raphael F. Smith 2 Nov. 1964 17 p refs

(NSAM-906; AD-632680) CFSTI: HC $1.00/MF $0.50

The master two-step test, Harvard step test, and the bicycle ergometer have particular features that are useful in testing different groups of patients. In order to have interchangeability of these tests, it is necessary to determine work loads that are equivalent and to consider the factors that influence physiological stress. This report describes the relationship of net oxygen consumption and external work, and graphs are included from which comparison of the oxygen cost of work tasks can be obtained. The oxygen cost of the double Master test was found to be less than for the lowest practical level of work of the Harvard step test. The 20 steps per minute rate on the Harvard step device was found to be essentially the same as the 150 watt load on the Lanooy ergometer, for the military population with a more uniform, muscular physique. Adjusting the exercise load according to weight may introduce variability of stress rather than eliminate it. Author (TAB)

N66-30745# Pennsylvania State Univ., University Park. Dept. of Psychology.

SOME EVIDENCE FOR CODING PROCESSES DERIVED FROM CLUSTERING IN FREE RECALL

Charles N. Cofer Apr. 1965 9 p refs

(Contract Nonr-656(30))

(TR-4; AD-620190) CFSTI: HC $1.00/MF $0.50

Clustering in free recall has often been interpreted as arising from use of the category name as a coding response. Data relevant to this interpretation are presented and interpreted with regard to three free recall situations in which clustering is observed. It is concluded that category names do not play roles in clustering in the category clustering situation or in the difference in clustering found for sets of words which comprise all the items of a category as compared with word sets which do not exhaust a category. However, there is evidence that the greater clustering found for categorized pair members than for non-categorized pair members with equal associative overlap may be due to the greater codability of the categorized pairs. Author (TAB)

N66-30805# Federal Aviation Agency, Washington, D. C. Office of Aviation Medicine.

DEVELOPMENT AND EVALUATION OF A RADAR AIR TRAFFIC CONTROL RESEARCH TASK

Richard G. Pearson, Clifton E. Hunter, and Gilbert L. Neal Dec. 1965 34 p

(AM-65-31)

A system is described in which various elements of the radar air traffic controller's task can be presented repeatedly, reliably, and concurrently to each of six experimental subjects seated at separate task consoles. Programming of display conditions designed to test such operator skills as vigilance, problem solving, monitoring, and reaction time, and the electronic scoring of subject responses are accomplished automatically. Results from initial experimentation involving enroute ATC, terminal, and flight service station personnel support the design rationale for the experimental task. Approximately 8 hours of practice are required for subjects to integrate effectively all subtasks and to achieve a stable level of proficiency. Suggestions are made for use of the system in human factors research on ATC operator problems and for modification as a training device. Technical appendixes include description of a complete problem script and of the electrical-engineering design characteristics of the programming-data-acquisition system. Author

N66-31114# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

PSYCHOPHYSICAL METHODOLOGY. II: COMPARISON OF MEANS AND OF STANDARD DEVIATIONS OF THE ASCENDING AND DESCENDING METHOD OF LIMITS

Robert M. Herrick 31 Dec. 1965 17 p refs

(NADC-MR-6508; AD-628995) CFSTI: HC $1.60/MF $0.50

Assume that the probability of a 'Yes' response increases as the stimulus intensity increases. Then, on the basis of probability considerations alone (a) the mean threshold of the descending method of limits (DML) is greater than the mean threshold of the ascending method of limits (AML) and (b) σ of the DML threshold distribution may be greater than, equal to, or less than σ of the AML threshold distribution. Therefore, (a) the present method for evaluating errors of expectation and habituation is erroneous, (b) the 'just not noticeable difference' (jnnd) should always be larger than the 'just noticeable difference' (jnd), (c) conclusions about relative precision based on a comparison of σ s are wrong. Author (TAB)

N66-31119# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio.

AN ANALYSIS OF THE INERTIAL PROPERTIES AND PERFORMANCE OF THE ASTRONAUT MANEUVERING SYSTEM Final Report, Oct. 1964–Aug. 1965

Julius A. Tieber and Robert W. Lindemuth Wright-Patterson AFB, Ohio, AF Medical Res. Labs., Dec. 1965 25 p refs

(AMRL-TR-65-216; AD-622443) CFSTI: HC $6.00/MF $1.25

To predict the system performance in space, the inertial properties of the astronaut maneuvering system (AMS) were determined. An existing mathematical model of the human body was revised and improved on the basis of improved regression equations and additional anthropometric dimensions. A mathematical model of a space suit was designed on the basis of measurements of suited subjects and suit weight regression equations. These models were combined into a model of a suited body. A computer program calculated the inertial properties of this model and compared them with experimental data. Results indicated the following: (1) Horizontal accelerations are more efficient than vertical accelerations; (2) The effects of inertial cross-coupling cause considerable loss of efficiency in roll and yaw maneuvers; (3) System performance is better with smaller astronauts, not just because of inherently higher accelerations, but also higher efficiency factors; (4) Variations in attitude deadband width have no significant effect of performance; (5) Inertial cross-coupling and center of gravity and line-of-thrust misalignment will make attitude control difficult while performing maneuvers in the manual control mode. Author (TAB)

N66-31129# Aberdeen Proving Ground, Md. Army Limited War Lab.

BIOSENSING TECHNICS FOR HUMAN DETECTION. II: THE FROG SKIN TRANSDUCER: A CONTINUOUS FLOW SYSTEM FOR MAKING CRITICAL MEASUREMENTS

Alfred T. Kornfield and Max Krauss Aug. 1965 18 p refs (TM-65-02; AD-621268) CFSTI: HC $1.00/MF $0.50

Earlier results in which transmembrane potential changes were elicited across frog belly skin by a number of compounds were duplicated. Four additional compounds were tested, including dimethyl sulfoxide. Dimethyl sulfoxide has no apparent adjuvant action when tested with urea. Measurements were attempted using low concentrations of test compounds by an expanded scale technique. The static 2-chamber cell is not suitable for this type of measurement. A continuous flow cell was assembled and tested. This system should permit critical measurement of effects of low concentrations of heat substances and it also provides a point of departure for design studies leading to development of a practicable field detection instrument. Author (TAB)

N66-31163*# North American Aviation, Inc., Los Angeles, Calif.

DEVELOPMENT AND TESTING OF A PROTOTYPE RESPIRATION ANALYZER Final Report

J. W. Raeke and D. M. Walton 14 Dec. 1964 81 p (Contract NAS4-367)

(NASA-CR-57209; NA-64-1298) CFSTI: HC $3.00/MF $0.75 CSCL 06B

The components of the respiration analyzer for in-flight monitoring of human subjects and the test procedures used are described. Details are given on the carbon dioxide, oxygen, pressure, and temperature sensors, and the mass flowmeters. Test runs at ground level and at 25,000 ft were conducted. It was concluded that the accuracy and response characteristics of the various prototype components are satisfactory except for the pressure sensor. The characteristics of the oxygen analyzer were considered outstanding. It was further concluded that the parameters chosen for measurement gave a satisfactory indication of total respiratory function. It is pointed out that provisions must be made for transferral of analyzer output to tape for data reduction on an analog computer. N.E.N.

N66-31164*# Autonetics, Anaheim, Calif. Research, Engineering, and Reliability Div.

THEORETICAL ASPECTS OF METAL-ELECTROLYTE INTERFACES Final Report

V. W. Bolie and L. G. Bishop 14 Sep. 1964 66 p refs (Contract NAS4-566)

(NASA-CR-57211; C4-1472/3111) CFSTI: HC $3.00/MF $0.75 CSCL 06B

Characteristics of bioelectrodes and chemical electrolysis cells, and difficulties encountered in monitoring human bioelectric activity are discussed. Skin surface electrodes, gross implantable electrodes, microelectrodes, and associated problems in both in-vivo and in-vitro applications are discussed. Anatomical structure and physiological variables pertinent to measurement of galvanic skin responses and electrode design are given. A study of metal–metal salt combinations in chemical electrolysis cells resulted in the prediction that the electrolyte tends to concentrate in the vicinity of one electrode, and to deplete in the region near the other. It is pointed out that electrochemical potentials can be used to predict contact potentials at interfaces, and rate processes at the electrodes can be used to predict chemical electrode potentials. A new technique using surface field effect transistors for measuring skin potentials is outlined. Measurements on a copper–copper sulfate cell show that the system has reactive impedance and exhibits a resonance at 210 cps. N.E.N.

N66-31288# Bell Helicopter Co., Fort Worth, Tex.

EVALUATION OF THE RH-2 COCKPIT MOCK-UP

James G. Curtin, Dora J. Dougherty, and John H. Emery Aug. 1965 65 p refs (Contract Nonr-4429(00))

(D228-410-001; AD-633106) CFSTI: HC $3.00/MF $0.75

This study represents one in a series of evaluations of the JANIAR concept of an IFR flight display system. The purpose of this experiment was to determine the feasibility of the cockpit layout and sub-panel design in terms of accessibility, operability in real time, the effect of training, and the performance of the required procedures. A concurrent objective was to examine means of improving the tested design. Testing was performed in a mock-up of the JANAIR Research Helicopter Number Two (RH-2) located at Bell Helicopter Company's Flight Simulation Laboratory. Five subject pilots learned and performed procedures for all flight test maneuvers. The procedures encompassed all manipulatory tasks to be performed throughout the simulated flight. Performance measures taken included: number of errors committed and time required to perform the procedures. Summary analyses of the findings indicate: (1) the time allowed to perform the required procedures is realistic and sufficient so as to preclude overburdening a single operator in flight, (2) some control knobs and selectors were inconveniently located on the right side of the panel, and (3) minor revisions were indicated to optimize procedures performance. The significance of the results is discussed and recommendations for optimum control design are noted. Author (TAB)

N66-31322# Bell Helicopter Co., Fort Worth, Tex.

CONTACT ANALOG SIMULATOR EVALUATIONS: NUMERIC AUGMENTATION OF GRID PLANE ENCODEMENT

J. H. Emery and Carl A. Koch Dec. 1965 35 p refs (Contract Nonr-4429(00))

(D228-420-007; AD-633107) CFSTI: HC $2.00/MF $0.50

Measurement was made of the ability of a group of helicopter pilots to perform simulated rotary wing maneuvers under three instrument display conditions which augmented the JANAIR contact analog vertical display with numeric information, moving tape scales, moving pointer scales and digital readouts. Each presented with the basic grid plane were compared with each other and the basic grid plane alone. The numeric information displayed included indices of altitude, heading and airspeed. The display conditions were tested under: (1) a relatively stable cruise task and (2) a variable terrain following task. Measures of altitude control, airspeed control, heading control and appropriate collective control inputs were recorded. Results indicate that numeric information significantly enhanced performance when presented in conjunction with the contact analog and that the moving tapes and the moving pointers each produced significantly better performance scores than the digital readouts. These results were consistent in both helicopter tasks tested. Author (TAB)

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N66-30043# Naval Radiological Defense Lab., San Francisco, Calif.

PERMANGANATE AS A CESIUM PRECIPITANT. APPLICATION TO RADIOCHEMISTRY

William H. Shipman and David Mueller 19 Feb. 1966 16 p refs

(USNRDL-TR-996; AD-632283) CFSTI: HC $1.00/MF $0.50

The coprecipitation of ammonium salts frequently occurs when cesium is determined gravimetrically. The use of cesium permanganate as the final precipitant is suggested, since ammonium permanganate is quite soluble and will not coprecipitate. Author

N66-30083*# National Aeronautics and Space Administration, Washington, D. C.

A METHOD FOR THE NONDISPERSIVE ANALYSIS OF VERY LIGHT ELEMENTS [UNE METHODE D'ANALYSE NON DISPERSIVE DES ELEMENTS TRES LEGERS]

Raymond Castaing and Francoise Pichoir Jul. 1966 36 p refs Transl. into ENGLISH from Le Rech. Aerospatiale (Seine), no. 108, 1965 p 3–16

(NASA-TT-F-422) CFSTI: HC $1.00/MF $0.50 CSCL 07D

The adaptation to spectrographic analysis by X-ray emission of the double filter method initially suggested by Ross for diffusion studies has been extended to the analysis of the very light elements. For relatively low (2000 V) electron acceleration voltages, an important intensity of the characteristic X-radiation and a relatively high signal-to-noise ratio are obtained. Author

N66-30114# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL DETERMINATION OF THE ELECTRICAL RESISTANCE OF LIQUID ALKALI METALS UP TO 1000°C

B. Ye. Semyachkin and A. N. Solov'yev *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 350–352 refs (See N66-30086 17-23)

Experimental determinations were made of the electrical resistance of lithium, sodium, potassium, rubidium, and cesium. A table which shows the value of the electrical resistance, and the temperature at which the value was obtained is provided. H.S.W.

N66-30126# Electrochemical Society, Inc., New York.

SYMPOSIUM ON ELECTRODE PROCESSES OF THE THEORETICAL DIVISION

[1966] 427 p refs Presented at Electrochem. Soc., Inc., Spring Meeting, Cleveland, Ohio, 1–6 May 1966; Sponsored by AFOSR

(Contract AF 49(638)-1647)

(AFOSR-66-0638; AD-631316) CFSTI: HC $7.85/MF $2.25

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N66-30127# New York Univ., N. Y. Dept. of Chemistry.

DOUBLE LAYER STUDIES

Paul Delahay *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 1–14 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

The following aspects of electrical double layers were studied: (1) Specific adsorption of inorganic cations, and resolution of simultaneous anion and cation specific adsorption in thallium/hydrogen electrolytic systems; (2) measurement of double layer differential capacity in Hg/NaF system by differential coulostatic method; and (3) examination of the charging process in the double layer of an electrode by the usual

relaxation and perturbation methods of electrode kinetics. Interpretation of differential charge capacity measurements under dynamic conditions showed that the double layer energy capacity was time or frequency dependent and significantly different from that of the supporting electrolyte. G.G.

N66-30128# Texas Instruments, Inc., Dallas.
DISCRETENESS-OF-CHARGE MICROPOTENTIALS. III: DIELECTRIC-CONDUCTIVE IMAGING
J. Ross MacDonald and C. A. Barlow, Jr. *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 15–54 refs (See N66-30126 17-08) CFSTI: HC $7.85/MF $2.25

A convenient general method for calculating potentials and fields arising from planar arrays of discrete adions under a variety of imaging conditions is described and illustrated. Adions are perfectly imaged by one conducting plane (single imaging) and are also imaged by a dielectric constant discontinuity at a plane on their other side. The method employs only solutions of the single imaging problem and is pertinent to the usual electrolyte compact layer adjoining either an electrode or a dielectric material. Although we apply the method to regular hexagonal arrays it is equally applicable to arrays described by Grahame's partially smeared, cut-off model for single imaging. In addition to calculating and illustrating the variation of field and potential within the compact layer and the adjoining dielectric medium, the present study includes single conductive plane imaging and also the (infinite) conductive–conductive imaging situations as special cases. Finally, the effect of possible conductive imaging by the electrolyte diffuse layer is considered qualitatively. Author

N66-30129# Bristol Univ. (England). Dept. of Physical Chemistry.
THE ADSORPTION OF AROMATIC SULPHONICS AT A MERCURY ELECTRODE. PART 2: SODIUM P-TOLUENESULPHONATE—AN EXAMPLE OF TWO POSITION ADSORPTION
J. M. Parry and R. Parsons *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 56–78 refs (See N66-30126 17-08) CFSTI: HC $7.85/MF $2.25

The adsorption of the p-toluenesulphonate ion on a mercury surface from aqueous solution has been studied by measuring the interfacial tension and the capacity of the electrode as a function of concentration. An interpretation of the results is proposed in terms of two orientations of the adsorbed ion. A simple model for this type of system is proposed, at first neglecting interaction between adsorbed ions other than due to their space-filling properties. A very approximate allowance for interaction is introduced and it is concluded that consideration of interaction is essential for a full description of the system. Author

N66-30130# Air Force Cambridge Research Labs., Bedford, Mass.
THE STRUCTURE OF THE MERCURY-SOLUTION ELECTRICAL DOUBLE LAYER IN THE PRESENCE OF ADSORBED OXYANIONS
Richard Payne *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 79–106 refs (See N66-30126 17-08) CFSTI: HC $7.85/MF $2.25

Electric capacity of the double layer at a dropping mercury electrode was measured for seven concentrations of KNO_3 by using the alternating current bridge method. Total inner layer capacity, and the capacity at constant amount adsorbed, were evaluated as functions of the KNO_3 concentrations. Curves in both cases were almost independent of the salt concentration. The differential capacity values of the double layer at the mercury electrode were attributed to nitrate ion adsorptions from the KNO_3 solution in the diffuse layer G.G.

N66-30131# Academy of Sciences (USSR), Moscow. Inst. of Electrochemistry.
SOME ASPECTS OF THE THERMODYNAMICS OF THE PLATINUM HYDROGEN ELECTRODE
A. N. Frumkin, N. A. Balashova, and V. E. Kazarinov *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 107–144 refs (See N66-30126 17-08) CFSTI: HC $7.85/MF $2.25

The double adsorption layer on platinum hydrogen electrodes was studied by thermodynamic determinations of the zero charge potential in different solutions, formation of free charges and ions, and the presence of adsorbed ions on the electrode surface. Data obtained by different methods showed fair agreement in the case of minimum specific adsorption. This quantity shifted to more negative values in adsorption of the anions Cl^- and Br^-, and in the direction of more positive values in adsorption of the Cd^{2+} ion. G.G.

N66-30132# Brussels Univ. (Belgium).
ION-PAIRING MECHANISMS IN ELECTRODE PROCESSES
L. Gierst, L. Vandenberghen, E. Nicolas, and A. Fraboni *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 145–195 refs (See N66-30126 17-08) CFSTI: HC $7.85/MF $2.25

Concentrated solutions of supporting electrolytes with the most common mono- and divalent cations were studied for their ion pairing mechanisms with composition changes at constant double-layer structure. Experiments were carried out in three-electrode cells with mercury drop electrodes. Data analyses showed that electrostatic ion-pairing was the dominant factor responsible for increases in rate constants; a water structure-enforced ion-pairing mechanism was indicated for perrhenate in Cs^+ solutions and can be predicted in tetraalkylammonium solutions due to the anionic effect of ion adsorbtions. It was concluded that the simple Gouy–Chapman system predicted pairing rate values in reasonable agreement with the magnitude of the observed kinetic effects. G.G.

N66-30133# Hokkaido Univ., Sapporo (Japan). Research Inst. for Catalysis.
PERIODIC VARIATION OF EXCHANGE CURRENT DENSITY OF HYDROGEN ELECTRODE REACTION WITH ATOMIC NUMBER AND REACTION MECHANISM
Hideaki Kita *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 196–228 refs (See N66-30126 17-08) CFSTI: HC $7.85/MF $2.25

The heterogeneous hydrogen catalysis $2H^+ + 2e^- = H_2$ was studied on various metals for the determining activity factor and the respective hydrogen electrode reaction mechanism. Considered were the activity relationships of the various metals to their properties such as atomic number, heat of atomatization of the metal, heat of adsorption of hydrogen on the metal, work function, etc. It was concluded that the bulk property of the electrode materials was the determining factor for the activity of hydrogen electrodes. A survey on hydrogen electrode reactions showed that the logarithm of the exchange

current density was a periodic function of the electrode element's atomic number and that the periodic variation was mostly affected by the bulk property of the electrode material. G.G.

N66-30134# Southampton Univ. (England). Dept. of Chemistry.

THE PRESSURE-COEFFICIENT OF THE HYDROGEN ELECTRODE REACTION

G. J. Hills and D. R. Kinnibrugh *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 229–252 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

The various criteria for the mechanism of the hydrogen electrode reaction are considered with particular reference to the pressure-coefficient of the reaction rate. The techniques of studying electrode processes at pressures up to 1500 atm are described and the volume of activation derived for the hydrogen evolution reaction has been found to be -3.4 ml mole^{-1}. This negative value is not in accord with either of the two mechanisms usually proposed for this reaction. It suggests that the rate-determining step is the stage e(metal)→e(aq) i.e., the emission and hydration of metallic electrons. Author

N66-30135# Newcastle Univ. (England). Dept of Physical Chemistry.

SOME PROBLEMS IN ELECTRODEPOSITION

J. A. Harrison, S. K. Rangarajan, and H. R. Thirsk *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 253–280 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

Fundamental studies of anodic and cathodic electrocrystallization processes are surveyed and recent work on the deposition mechanism is outlined. Considered are non-metallic depositions by potentiostatic techniques, relaxation methods through programmed pulse train potentials, as well as the kinetics of metal deposition onto mercury and graphite substrates. Non-metallic and metallic deposits differ only in the individual properties of their lattice structures. Metallic lattices tend to form at much higher rates and their preceding transport processes could be rate determining. G.G.

N66-30136# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.

AN ELLIPSOMETRIC DETERMINATION OF THE MECHANISM OF PASSIVITY OF NICKEL

J. O'M. Bockris, A. K. N. Reddy, and B. Rao *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 281–318 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

In situ examinations of the formation, growth, and characteristics of nickel passivation in acid solution by the growth of anodic film are reported. Steady state ellipsometric evaluation of current density-potential plots and galvanostatic and potentiostatic reduction curves demonstrated that a thick (not less than 45 Å) three-dimensional film is formed at a potential distinctly cathodic to the passivation potential. Conversion of this precursor film into a non-stoichiometric, oxide semiconductor constituted the essential step in the mechanism of passivation and reduced corrosion drastically; thus the conversion of a multilayer from ionic to electronic conduction was the essential cause of passivity. G.G.

N66-30137# Ottawa Univ. (Ontario). Dept. of Chemistry.

OXIDE INVOLVEMENT IN SOME ANODIC OXIDATION REACTIONS

B. E. Conway, N. Marincic, D. Gilroy, and E. Rudd *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 319–370 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

A comparative study of the involvement of surface oxides of platinum in the anodic oxidation of (a) formate, (b) hydrocarbons and (c) hydrazine has been made. In case (a) the oxidation has also been studied in two rigorously dehydrated non-aqueous solvents, acetonitrile and propylene carbonate to which were successively added initially traces and later larger quantities of water. Activation and inhibition effects arise and are related to the water content of the solutions. The oxide coverages were determined at various potentiostatically held potentials E by cathodic galvonostatic and differentiated galvanostatic transients for ascending and descending directions of change of E. Complications which may arise in the quantitative interpretation of results obtained from the repetitive potentiodynamic method are illustrated. Author

N66-30138# Tyco Labs., Inc., Waltham, Mass.

ELECTROCHEMISTRY OF SURFACE OXIDES

A. C. Makrides *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 371–381 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

The effects of surface oxides on oxygen reduction and evolution, on hydrogen peroxide reactions, on hydrogen reactions, and on the kinetics of simple redox reactions involving ions in solution were studied. Kinetics of very thin gold oxide films showed a direct logarithmic relationship between the reduction charge for the anodic film formed on gold, and the formation time. G.G.

N66-30139# Cyanamid European Research Inst., Geneva (Switzerland).

CHARGE TRANSFER PROCESSES AT ORGANIC INSULATOR ELECTRODES

W. Mehl, J. M. Hale, and F. Lohmann *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 382–404 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

Charge transfer reactions at insulator electrodes are discussed in terms of the model developed for such processes at semiconductor electrodes. A simplifying condition is here that only such reactions are possible which lead to the injection of holes into the valence band or of electrons into the conduction band. Measurements at anthracene electrodes showed complete agreement with the predictions derived from the model including the possibility of having reversible charge transfer reactions. Author

N66-30140# Technische Hochschule Munchen (West Germany). Inst. of Physical Chemistry.

ELECTROCHEMICAL BEHAVIOR OF SEMICONDUCTORS UNDER ILLUMINATION

H. Gerischer *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 405–434 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

The photo-electrochemical effect caused by absorption of light in a semiconducting electrode was studied for the case where the composition of the electrode was not changed.

Calculations showed that the recombination rate and the numbers of electrons and holes present under equilibrium conditions affected the excitation of electronic carriers at illumination. Main illumination effects on semiconductors were due to: (1) deviation from equilibrium for minority carrier concentration in the region under the surface outside the space charge layer; and (2) deviation from equilibrium for charge distribution in the space charge layer to distribute the flow of electrons and holes to the interior and the surface. Photoemission at semiconductors were more pronounced as the band gap energy increased. It was concluded that reactions of minority carriers are the controlling processes in photo-electrochemical effects on semiconducting electrodes. G.G.

N66-30141# United Kingdom Atomic Energy Authority, Harwell (England).

PHOTO-CURRENTS PRODUCED BY ULTRA-VIOLET IRRADIATION OF MERCURY ELECTRODES

G. C. Barker, A. W. Gardner, and D. C. Sammon *In* Electrochem. Soc., Inc. Symp. on Electrode Processes of the Theoret. Div. [1966] p 435–478 refs (See N66-30126 17-06) CFSTI: HC $7.85/MF $2.25

Photo-currents characterized by a dependence on the square root of the scavenger concentration are mainly due to the photo-emission of electrons from the electrode surface. The dependence of the apparent threshold potential on wavelength, the values of relative rate constants deduced from competitive and comparative scavenging experiments, and the influence of ionic strength on the photo-current are the main evidence for this conclusion. The apparent range deduced from the departure from linearity of the relation between current and the square root of the scavenger concentration indicates that the electrons travel an appreciable distance through the solution before becoming hydrated. No reliable evidence is yet available to show whether after thermalization the electrons travel a further distance prior to hydration. The hard core of evidence for electron emission has in the present paper been embellished with much speculation mainly concerned with the nature of the reactions following the scavenging reacton. Author

N66-30143# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRIC AND MAGNETIC PROPERTIES OF POLYARYLENQUINONES

A. A. Dulov, B. I. Liogon'kiy et al 8 Jun. 1965 8 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Khimicheskaya (USSR), no. 5, 1964 p 909–912
(FTD-TT-65-158/1+2; AD-618645) CFSTI: HC $1.00/MF $0.50

A relationship was revealed between the structure of molecules, density of their packing and electrical properties of polyarylenquinones. Established was the fact of sharp reduction in resistance when polyarylenquinones are reduced into stable semiquinone form. Author

N66-30144# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EFFECT OF RADIOACTIVE RADIATION OF ^{35}S AND ^{99}Mo ON SPECIFIC SURFACE VALUE OF MOLYBDENUM DISULFIDE

V. I. Spitsyn, I. Ye. Zimakov, and N. P. Dobrosel'skaya 12 May 1965 12 p refs Transl. into ENGLISH from Radiokhimiya (USSR), vol. 6, no. 1, 1964 p 130–132
(FTD-TT-65-26/1+2; AD-618638) CFSTI: HC $1.00/MF $0.50

Compounds of molybdenum disulfide containing varying amounts of radioactive molybdenum 99 and sulfide 35 isotopes were synthesized and the effects of the incorporated isotopic radiation on the surface properties of the specimens were studied by comparison with nonradioactive samples. Obtained results showed that radioactive and nonradioactive samples corresponded to the MoS_2 composition; the specific surface magnitude of radioactive MoS_2 samples increased in proportion to the growth of specific radioactivity. However, radioactive radiation exerted an effect on the surface magnitude of radioactive compounds only during the formation process of MoS_2 crystals. It was concluded that the surface change in radioactive crystals is probably related to the various radiation induced lattice defects when the substance is crystallizing. G.G.

N66-30150# Bureau of Mines, Albany, Oreg. Metallurgy Research Center.

CARBON REDUCTION OF CHROMITE

Willard L. Hunter and Danton L. Paulson 1966 28 p refs
(BM-RI-6755)

The effect was studied of temperature upon the reduction of chromite by carbon and the relative reducibility of chromites as a function of their composition. Ferric oxide was also studied to provide comparative data. Pellets weighing approximately 1 gram and containing 70 percent ferric oxide, chromic oxide, or chromite and 30 percent graphite were subjected to closely controlled temperatures under a flow of argon for 15 minutes. The amount of CO and CO_2 evolved was measured, and the reduced sample was analyzed by X-ray diffraction techniques. The reduction of Fe_2O_3 was studied over a temperature range of 600° to 1400° C, while the reduction of Cr_2O_3 and chromite was conducted from 900° to 1621°C. The temperature above which appreciable reduction of Cr_2O_3 by graphite took place was 1125°C. The temperature at which significant reduction started for three of the four chromite samples was approximately the same, indicating that there was concurrent reduction of iron and chromium oxides in the chromite mineral rather than selective reduction of iron oxides followed by reduction of chromic oxide. Rhodesian chromite appeared to dissociate at a lower temperature with concurrent reduction of iron. Author

N66-30162*# Pennsylvania State Univ., University Park. Materials Research Lab.

RESEARCH ON THE MECHANISM AND KINETICS OF OXIDATION OF SILICON IN AIR Second Semiannual Report, 1 Dec. 1965–31 May 1966

K. Vedam, V. Prosser, and R. Rai 20 Jun. 1966 28 p refs
(Grant NGR-39-009-042)
(NASA-CR-76098) CFSTI: HC $2.00/MF $0.50 CSCL 07D

This report describes the progress of the work on the ellipsometer studies on the growth of thin oxide films on silicon. The experimental work involved the detailed calibration of the various components of the ellipsometer and the fabrication of a device for cleaving silicon in ultra high vacuum or liquids. Theoretically the interesting case of light being incident from a denser liquid onto the film has been considered when the angle of incidence is (1) less than the critical angle and (2) greater than the crictical angle. In the first case detailed calculations indicate that an increased sensitivity of up to about

ten times that reported so far can be achieved by working near the critical angle and there is a possibility of determining experimentally the refractive index and the thickness of the film individually. The theory for the case (2) has been worked out and computations are being made. Author

N66-30193# Technische Hogeschool, Eindhoven (Netherlands).

FORMATION AND SPECTRA OF TRI-METHYL-CYCLOPENTADIENES

Jan Willem de Haan (Ph.D. Thesis) [1966] 126 p refs
CFSTI: HC $4.00/MF $1.00

This paper deals with mechanistic studies concerning the isomerization reactions of tri-methyl-cyclopentadienes and with the structure confirmation of reactants and products. If tri-methyl-cyclopentadienes are subjected to a Diels–Alder synthesis with ethylene as the dienophylic agent, the reaction products are tri-methyl-norbornenes. These and other strained bicyclic compounds represent an interesting class of subjects which were studied by means of nuclear magnetic resonance spectroscopy. Included are discussions on the thermolysis of fenchyl-, bornyl-, and isobornyl acetate, the isolation and thermal behavior of some tri-methyl-cyclopentadienes, the structure assignments and spectra of the tri-methyl-cyclopentadiene compounds, and the formation and nuclear magnetic resonance study of some bridged ring compounds of the norbornene type. R.N.A.

N66-30195# Joint Publications Research Service, Washington, D. C.

NITRIDE REFRACTORIES PRODUCED BY THE ALUMONITROSILICOTHERMAL METHOD

K. S. Kutateladze, Ye. N. Zedginidze, and R. A. Karumidze 8 Jul. 1966 16 p refs Transl. into ENGLISH from Ogneupory (Moscow), no. 12, 1965 p 8–13
(JPRS-36367; TT-66-32799) CFSTI: $1.00

A method is described for producing nitride refractories through the use of the alumonitrosilicothermal technique. The method is based on the reaction of aluminum powder with refractory clays when the mixture is fired in a purified nitrogen fed into the furnace. The resulting refractory possesses high quality physico-chemical and mechanical properties. R.N.A.

N66-30200# International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Tempratures and Refractories.

BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE, JANUARY, FEBRUARY, MARCH 1966, VOLUME 1966, NO. 1

J. J. Diamond, ed. (Natl. Bur. of Standards) [1966] 73 p refs

A bibliography is presented on (1) devices for achieving temperatures above 1500°C, (2) devices for measuring and controlling temperatures above 1500°C, (3) devices for physical measurements at temperatures above 1000°C, (4) properties, at temperatures below 1000°C, of metallic, nonmetallic, and mixed materials which melt above 1500°C, (5) properties, at temperatures above 1000°C, of metallic, nonmetallic, and mixed materials which melt above 1500°C, (6) properties, at temperatures above 1000°C, of metallic and nonmetallic materials which melt below 1500°C, (7) phase equilibria, and (8) reactions at temperatures above 1000°C. R.N.A.

N66-30201# International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Temperatures and Refractories.

BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND PLASMAS

L. Brewer, comp. (Calif. Univ.) 31 Mar. 1966 36 p refs
(Rept.-18)

A bibliography is presented which contains references on spectroscopy of interest to high temperature chemistry, and reactions between gases and condensed phases. R.N.A.

N66-30210# Eltex Research Corp., Lincoln, R. I.

THE DEVELOPMENT OF CHELATING AGENTS FOR ENHANCING THE URINARY EXCRETION OF STRONTIUM, 1 FEBRUARY 1963–1 DECEMBER 1964

Harry Kroll, Melvin A. Lipson, and Edward F. Bolton 11 Mar. 1966 33 p refs *Its* Rept.-3
(Contract AT(30-1)-2710)
(TID-22717) CFSTI: HC $2.00/MF $0.50

An attempt was made to synthesize meso- and d,l-stilbendiamine tetraacetic acid for a study on the stereo-chemical factors influencing chelation reactions. The investigation did not yield the desired chelating agents. A new synthetic route was developed for the synthesis of diethylene triamine used as an intermediate in the synthesis of chelating agents. The utility of the synthesis is discussed. Bis N,N'[dicarboxymethyl(2-aminoethyl] selenide was synthesized and the stability constants for the alkaline earth chelates of this compound was determined and compared with similar values obtained from related compounds in which the selenium is replaced by other Group VI elements. Author (NSA)

N66-30212# California Univ., Riverside. Dept. of Soil and Plant Nutrition.

ACCUMULATION OF CERIOM, YTTRIUM, AND CESIUM IN PLANTS AS AFFECTED BY THEIR SOIL CHEMISTRY AND THE AERATION OF THE SOIL Progress Report, 1 Jun. 1965–31 May 1966

N. T. Coleman [1966] 34 p refs
(Contract AT(11-1)-34)
(TID-22715) CFSTI: HC $2.00/MF $0.50

Results are summarized from studies on the accumulation of Cs in plants as affected by soil chemistry. Four soil materials were used to determine how minerals, especially biotite, hydrobiotite, and vermiculite control the availability of Cs to the plants and to establish the role of K, NH_4, and general salt concentration in modifying plant availability under various soil mineral regimes. The textural and general chemical characteristics of the soil samples are summarized. Data are presented from tracer studies of the sorption of Cs under different Cs levels; the Cs fixing capacity under various Cs concentrations; sorption–desorption characteristics of trace amounts of Cs in various soil types and with various salt concentrations; and the uptake of Cs by Sudan grass. (14 references.) NSA

N66-30286# Allied Chemical Corp., Morristown, N. J. Central Research Lab.

ORIENTED BASIC RESEARCH IN PHYSICAL SCIENCES: HIGH PRESSURE BASIC RESEARCH PROGRAM Final Report, 1 Apr. 1964–31 Mar. 1965

L. F. Nienart, J. L. Bach, W. M. Beyleveld, and C. Woolf Mar. 1965 57 p refs
(Contract DA-31-124-ARO(D)-201)
(AROD-4993-1; AD-631374) CFSTI: HC $5.60/MF $0.50

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1. THE EFFECT OF PRESSURE ON THE MELTING POINT OF SODIUM HALIDES L. F. Nienart 31 p refs (See N66-30267 17-06)

2. REACTIONS OF PHENYL ISOCYANATE AT HIGH PRESSURES J. L. Bach, W. M. Beyleveld, and C. Woolf 20 p refs (See N66-30268 17-06)

N66-30267# Allied Chemical Corp., Morristown, N. J. Central Research Lab.

THE EFFECT OF PRESSURE ON THE MELTING POINT OF SODIUM HALIDES

L. F. Nienart *In its* Oriented Basic Res. in Phys. Sci. Mar. 1965 31 p refs (See N66-30266 17-06) CFSTI: HC $5.60/MF $0.50

The D.T.A. technique was used to obtain the fusion curves of NaBr, NaCl, and NaF to pressures of 12, 43 and 45 kilobars respectively. A piston–cylinder pressure device was used to press the sodium halides contained in a nickel capsule and surrounded by a pressure transmitting medium composed of talc, magnesium oxide, graphite, boron nitride, and lead. Under pressure, the salt was melted by resistance heating a graphite tube which was electrically insulated from the metallic pressure vessel by talc and the nickel capsule by a boron nitride tube. Differential and reference thermocouple junctions placed in the center of the pressure capsule produced the e.m.f. signals which were recorded. The constants c and A of the Simon melting equations were computed from the experimental results. Author

N66-30268# Allied Chemical Corp., Morristown, N. J. Central Research Lab.

REACTIONS OF PHENYL ISOCYANATE AT HIGH PRESSURES

J. L. Bach, W. M. Beyleveld, and C. Woolf *In its* Oriented Basic Res. in Phys. Sci. Mar. 1965 20 p refs (See N66-30266 17-06) CFSTI: HC $5.60/MF $0.50

At 16 kb and a temperature range of 175–225°C phenyl isocyanate was converted to its cyclic dimer (1,3-diphenyl-2,4-uretidinedione) in greater than 90% yield. The dimerization reaction was shown to be favored by pressure. At higher pressures the temperature range was extended, e.g., at 32 kb and 350° C the yield of dimer was greater than 70% whereas at 16 kb and the same temperature none of the dimer was isolated. Both the cyclic trimer (triphenyl isocyanurate) and another dimer of phenyl isocyanate (3-phenyl-2,4-dioxotetrahydroquinazoline) were the principal products formed at a pressure of 16 kb and temperatures equal to or greater than 275°C. At these higher temperatures carbon dioxide was identified as the sole gaseous product. This gas may arise by the pyrolysis of yet another phenyl isocyanate dimer having a four membered ring lactone structure. At 8 kb and 250°C the major product of the reaction is thought to be a 2:1 cyclic trimer of phenyl isocyanate and diphenylcarbodiimide. Author

N66-30272# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TRANSACTIONS OF THE MOSCOW INSTITUTE OF PETROCHEMICAL AND GAS INDUSTRY [MOSKOVSKIY ORDENA TRUDOVOGO KRASNOGO ZNAMEINI INSTITUT] Selected Articles

20 Jul. 1965 31 p refs Transl. into ENGLISH from the publ. "Petrochemistry. Processing of Oil and Gas" no. 28. Moscow, Gostoptekhizdat, 1960 p 44–55, 56–67 (FTD-MT-64-512; AD-619476) CFSTI: HC $2.00/MF $0.50

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1. INFLUENCE OF CHEMICAL NATURE AND STRUCTURE OF HIGH-POLYMER ADDITIVES ON VISCOSITY PROPERTIES OF OILS OF DIFFERENT CHEMICAL COMPOSITION D. S. Velikovskiy and L. V. Chervova p 1–13 refs (See N66-30273 17-06)

2. SYNTHESIS OF NEW ANTIOXIDANT ADDITIVES V. I. Isagulyants and N. A. Favorskaya p 14–26 refs (See N66-30274 17-06)

N66-30273# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF CHEMICAL NATURE AND STRUCTURE OF HIGH-POLYMER ADDITIVES ON VISCOSITY PROPERTIES OF OILS OF DIFFERENT CHEMICAL COMPOSITION

D. S. Velikovskiy and L. V. Chervova *In its* Trans. of the Moscow Inst. of Petrochem. and Gas Ind. 20 Jul. 1965 p 1–13 refs (See N66-30272 17-06) CFSTI: HC $2.00/MF $0.50

The viscosity properties of polymers of unsaturated hydrocarbons, and polymers of unsaturated esters or esters of unsaturated acids were investigated. These were polyisobutylene and polymethacrylates of normal and isostructure. The properties of the three oils tested, and the viscosity–temperature numbers of the oils with and without the additives, and with the additives in separate fractions are presented. Viscosity–temperature curves are also included. Among the conclusions are: (1) High polymer additives lead to sharp improvement of viscosity–temperature properties. (2) The chemical composition of the initial oils has little effect on the viscosity–temperature properties but does influence the viscosity. (3) The additives possess the least thickening effect in the naphthene–paraffin fractions of the oils, and polymethacrylates produce a larger thickening effect in the heavy aromatic fractions. (4) The thickening effect of the polymers is greater in the oils with small viscosity, and the thickening effect decreases with increase of temperature. N.E.N.

N66-30274# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS OF NEW ANTIOXIDANT ADDITIVES

V. I. Isagulyants and N. A. Favorskaya *In its* Trans. of the Moscow Inst. of Petrochem. and Gas Ind. 20 Jul. 1965 p 14–26 refs (See N66-30272 17-06) CFSTI: HC $2.00/MF $0.50

The steps in the synthesis of bisphenol additives and their effectiveness in insulating oils and motor fuels are reviewed. The stages are identified as the alkylation of phenols of olefins in the presence of catalysts, and the condensation of alkylphenols with formaldehyde in the presence of hydrochloric acid. The synthesis of 2,2'-methylene-bis-(6-tert-butyl-4-methylphenol) and the synthesis of 2,2'-methylene-bis(4,6-di-tert-butyl-3-methylphenol) are given as illustrations. It was found that the new additives are as effective as the standard in most cases, and exceed the standard in some. It was also concluded that the synthesized additives almost double the yield of anitoxidant additives by utilizing a by-product in the production of the standard additive. N.E.N.

N66-30284# Picatinny Arsenal, Dover, N. J. Feltman Research Labs.

THE CATALYTIC ACTIVITY OF METALS IN CHEMILUMINESCENT REACTION BETWEEN LUMINOL AND HYDROGEN PEROXIDE

A. K. Babko and N. M. Lukova'ka Sep. 1965 10 p Transl. into ENGLISH from Dopovidi Akad. Nauk Ukr. RSR (Kiev), 1962 p 619–621
(PA-TM-1711; AD-469403)

A comparison was made of the catalytic action of a number of salts on the chemiluminescent reaction between luminol and hydrogen peroxide. An instrument consisting of a photomultiplier, amplifier and recorder was used for the investigation. Data on the change in intensity of luminescence with time and the values of the sums of luminescence for 160 sec are presented for: $K_3Fe(CN)_6$, $KMnO_4$, $CuSO_4$ and CoC_{12}. It is shown that the first two substances bring about chemiluminescence without H_2O_2. For typical catalysts, such as cobalt and copper the great importance of the order of the components is discussed. Author (TAB)

N66-30307# Library of Congress, Washington, D. C. Aerospace Technology Div.

CHEMISTRY OF ORGANOMETALLIC COMPOUNDS. PART A: ORGANOSILICON AND ORGANOGERMANIUM CHEMISTRY Surveys of Communist World Scientific and Technical Literature

Edward Wolski 20 Apr. 1966 119 p refs Annotated bibliog.
(ATD-66-47)

Soviet-bloc open source literature dealing with experiments in organogermanium and organosilicon chemistry is reviewed in an annotated bibliography. Abstracts are included for most of the 129 entries. M.W.R.

N66-30432# European Atomic Energy Community, Brussels (Belgium).

THE USE OF THE X-RAY FLUORESCENCE SPECTROGRAPHY FOR THE ANALYSIS OF SOLUTIONS [L'APPLICATION DE LA SPECTROGRAPHIE DE FLUORESCENCE A L'ANALYSE DES SOLUTIONS]

G. Vos 1966 20 p refs In FRENCH; ENGLISH summary
(EUR-2951.f) CFSTI: HC $1.00/MF $0.50

The use of X-ray fluorescence analysis as a tool for determining trace or larger quantities of elements in organic and aqueous solutions is discussed. It is shown possible to cancel the influence of the matrix by the application of such techniques as the internal or external standard, absorption edge, addition methods, and scattered radiation standardization. D.T.

N66-30435# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

PREPARATION OF POTASSIUM CYANIDE-^{14}C BY THE ISOTOPIC EXCHANGE METHOD [OTRZYMYWANIE CYJANKU POTASOWEGO-C-14 METODA WYMIANY IZOTOPOWEJ]

Maria Wolska-Witerowa Dec. 1965 22 p refs
(INR-675/XIII/J) CFSTI: HC $1.00/MF $0.50

Optimum conditions for the isotopic exchange of carbon atoms between barium carbonate-^{14}C and nonradioactive potassium cyanide have been worked out. The exchange degree was 100% and the chemical yield was 95% based on the potassium cyanide used. The purity of obtained potassium cyanide was 96%. Author

N66-30436# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

PREPARATION OF C^{14}-LABELLED CARBOXYLIC ACIDS BY THE ISOTOPIC EXCHANGE METHOD [ZASTOSOWANIE METODY WYMIANY IZOTOPOWEJ DO OTRZYMYWANIA KWASOW KARBOKSYLOWYCH ZNACZONYCH WEGLEM-14]

Maria Wolska-Witerowa Dec. 1965 14 p refs
(INR-676/XIII/J) CFSTI: HC $1.00/MF $0.50

The isotopic exchange of the carbon atoms in the molecules of acids and salts by the exchange of the acid anions in a water free medium. A new method of the preparation of anhydrous formic acid-^{14}C, acetic acid-1-^{14}C and propionic acid-1-^{14}C has been elaborated. Author

N66-30448# Los Alamos Scientific Lab., N. Mex.

SEPARATION OF THE RARE EARTH ELEMENTS BY THE RELATIVE SOLUBILITY OF THEIR CARBONATES IN WATER SATURATED WITH CO_2 GAS

F. Trombe and P. Caro [1965] 10 p refs Transl. into ENGLISH from a French preprint from the 5th Rare Earth Res. Conf., Bk. 3 Chem. Session C, Ames, Iowa, Aug. 30–Sep. 1, 1965
(LA-TR-65-24)

Although carbonates of the rare earths and Y are not very soluble, the measurements performed indicate a great relative difference in the solubility between Y and the rare earths. The relative differences in solubility were exploited by means of metathetical reactions. This led to the easy separation of elements presenting, for example, two very insoluble hydroxides, but of very different relative solubility. This principle was applied to the separation of rare earths and Y by acting on the relative insolubility of their carbonates. However, the extraction yield was very small. A metathetical reaction of the type: $Y_2(CO_3)_3+2\ NdCl_3 \rightarrow Nd_2(CO_3)_3+2\ YCl_3$ permits a considerable increase in the amount of Y extracted from the mixture, by closely maintaining the proportions of the equilibrium of the individual solubility of the carbonates. The metathetical reaction is brought about by addition of a small amount of acid in the solution which dissolves part of the mixture. NSA

N66-30451# Union Carbide Nuclear Co., Oak Ridge, Tenn.

THERMIONIC EMISSION OF THE HEXABORIDES OF SAMARIUM AND GADOLINIUM

S. V. Ermakov and B. M. Tsarev [1965] 7 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 5, 1965 p 972–975
(K-TRANS-10) CFSTI: HC $1.00/MF $0.50

The thermionic emission of SmB_6, EuB_6 and GdB_6 on W and Ir substrates is measured at 1000° to 2000°K. The results are compared with previous results on LaB_6, TmB_6 and WB_x. NSA

N66-30452# Oak Ridge National Lab., Tenn.

PURIFICATION OF ZIRCONIUM TETRAFLUORIDE

L. B. Yeatts, Jr. and W. T. Rainey, Jr. Nov. 1965 24 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1292) CFSTI: HC $1.00/MF $0.50

The factors which were studied, during the purification of ZrF_4 by sublimation, for their effect upon the product purity level were the: rate of sublimation; rate of condensation of sublimate; successive or multistage sublimations; number and arrangement of baffles; and pre-treatment of the starting material. A single stage vacuum sublimation at 700° to 800°C with one baffle present was sufficient to lower the impurity level of

iron to less than 100 ppM. Pretreatment of the starting material with NH_4HF_2 and use of a more elaborate baffling system gave a product with an oxygen level of 250 ppM. The application of a vapor-zone sublimation technique seems potentially useful for ZrF_4 purification. Author (NSA)

N66-30453# Kernforschungszentrum, Karlsruhe (West Germany). Institut für Radiochemie.
PHOTOMETERPROG 4—AN IBM-7070 PROGRAM FOR CALCULATION OF STABILITY CONSTANTS FROM SPECTROPHOTOMETRIC MEASUREMENTS [PHOTOMETERPROG 4-EIN IBM 7070—PROGRAMM ZUR BERECHNUNG VON STABILITAETSKONSTANTEN AUS SPEKTRALPHOTOMETRISCHEN MESSUNGEN]
Siegfried Helmut Eberle May 1965 28 p refs In GERMAN
(KFK-250)

A program for the calculation of the stability constants at successive formation of the complexes MA and MA_2, where M=metal and A=anion of the ligands H_2A, is described for the IBM-7070. The extinctions measured at three wave lengths and the pH value of the aqueous solutions of the components were used as the measurement data. For evaluation it was assumed that only the metal-containing species contribute to the absorption and that the extinction modulus for M and MA_2 are known. The program looks for the stability constants K_1 and K_2 and the extinction mpdulus for MA which yields a minimum of a suitable selected error size. The FORTRAN list of the program statements and an example are given.
Author (NSA)

N66-30456# New Mexico Univ., Albuquerque. Dept. of Chemistry.
THE ELECTROCHEMISTRY OF SOME TRANSITION METALS AND LANTHANIDES DISSOLVED IN MOLTEN ALKALI METAPHOSPHATE Final Report, Jul. 1, 1964–Jun. 30, 1965
Roy D. Caton, Jr. [1965] 9 p Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-DC-65-1706; CONF-651027-1) CFSTI: HC $1.00/MF $0.50

A reference electrode ($Ag–AgPO_3$) for use in the metaphosphate melts was found and tested. The electrode is quite stable, attains its potential within 15 min, and is of rugged construction. Corning 1720 glass was found to possess the desirable properties of a salt bridge material, and is now being used in all the emf studies. An inert atmosphere container was designed and fabricated and an illustration is given. Preliminary studies that have been initiated but not completed are described. These include: use of chronopotentiometry as means of analyzing the melt for electroactive species; emf studies of transition metal Redox couples; and chemical reactions in the melt. NSA

N66-30476# Sandia Corp., Albuquerque, N. Mex.
A KINETIC STUDY OF THE CHANGE IN THE ABSORPTION SPECTRUM OF URANIUM (IV) SOLUTIONS, WITH TIME, AT LOW ACIDITIES
J. O. Wear Dec. 1965 13 p refs
(Contract AT(29-1)-789)
(SC-RR-65-629) CFSTI: HC $1.00/MF $0.50

The slow decrease in the uranium (IV) absorption spectrum with time was studied as a kinetic process. The change was found to be due to hydrolysis of U^{4+} and to obey the rate equation: $-d[U^{4+}]/dt = k_1(1+K/[H^+])[U^{4+}]$, where K is the hydrolysis equilibrium constant. The value of k_1 at 25°C and with $\mu = 1.0$ is 2.39×10^{-3} min^{-1}. The activation energy was found to be 5.51 kcal/mole. Author (NSA)

N66-30478# Oak Ridge National Lab., Tenn.
THE EFFECTS OF TRACE IMPURITIES OF MOISTURE, OXYGEN, HYDROGEN, NITROGEN AND CARBON DIOXIDE IN GLOVE BOX ATMOSPHERES ON THE ANALYSIS OF THE ALKALI METALS
Gerald Goldberg 10 Dec. 1965 11 p refs
(Contract W-7405-ENG-26)
(ORNC-TM-1357) CFSTI: HC $1.00/MF $0.50

A survey was made on the effects of atmospheric impurities during the handling of the alkali metals. Discussion is presented on: reactions between these impurities and the alkali metals; effects of impurities on some analytical procedures; and various dry box techniques for the handling of the alkali metals. Also included are suggested maximum permissible levels for these impurities as well as a bibliography of 30 references to pertinent publications. Author (NSA)

N66-30482# Brandeis Univ., Waltham, Mass. Dept. of Chemistry.
EFFECTS OF MERCAPTANS AND DISULFIDES ON PHOTOCHEMICAL AND HIGH ENERGY RADIATION INDUCED REACTIONS Progress Report, 1 Nov. 1964–1 Nov. 1965
Saul G. Cohen 1 Nov. 1965 21 p
(Contract AT(30-1)-2499)
(NYO-2499-17) CFSTI: HC $1.00/MF $0.50

Developments are reported for studies on: effects of mercaptan on photoreduction of benzophenone in ethers; photoreduction of 4-benzoylphenyltrimethylammonium chloride; photoreduction of aminobenzophenones; and effects of phenyl disulfide on flash photolysis of benzophenone in 2-propanol. NSA

N66-30483# Cornell Univ., Ithaca, N. Y. Dept. of Materials Science and Engineering.
SOLID–LIQUID INTERFACE Progress Report
Che-Yu Li 15 Nov. 1965 8 p refs
(Contract AT(30-1)-3228)
(NYO-3228-6) CFSTI: HC $1.00/MF $0.50

Studies were made on the properties of interfaces emphasizing the correlation between structure and properties. The understanding of the structure of the interface between silver chloride and aqueous solutions has been increased. The Nb–Li system was chosen for studies on interaction between a solid metal and a liquid metal at the grain boundary. The results showed that the kinetics of initial stage of the penetration process follows a $(\text{time})^{1/2}$ law with an activation energy of 33±5 kcal in a temperature range between 800° and 1000° C. It was also found that the penetration rate depends strongly on the rate oxygen segregates toward the grain boundary. NSA

N66-30484# Cornell Univ., Ithaca, N. Y. Materials Science Center.
ULTRASONIC ABSORPTION IN SODIUM CHLORIDE
Robert Arthur Moog (Ph.D. Thesis) Sep. 1965 144 p refs
(Contract AT(30-1)-2471)
(NYO-2471-11) CFSTI: HC $4.00/MF $1.00

The ultrasonic attenuation in sodium chloride was measured as a function of frequency, temperature, and dose of

gamma irradiation. The dependence of the attenuation upon amount of plastic deformation, orientation of specimen, and time after deformation, was also observed. Experimental techniques (pulse echo method) for the measurement of the ultrasonic attenuation in the frequency range 5–150 Mc/sec, and in the temperature range 5–300°K, and the preparation of sodium chloride specimens to which special attention had to be paid, are described. The non-dislocation contributions to the attenuation, i.e., the attenuation observed when the dislocations are pinned are discussed in terms of beam spreading, scattering from inhomogeneities, phonon scattering, and other phenomena. The dislocation contribution was interpreted in terms of the Granato–Lücke theory (damped string model). The frequency and orientation dependence of the decrement agreed with the theory to within the experimental error. A value for B (dislocation drag force) was computed and turned out to be of the same order of magnitude as in Cu. The temperature dependence of the decrement however did not agree with existing theories of others. The dependence of the decrement upon gamma irradiation revealed two components, one of which followed the Granato–Lücke theory, while the other did not. Author (NSA)

N66-30562# Rock Island Arsenal Lab., Ill. Research and Engineering Div.

SYNTHESIS OF AMINOQUINONE POLYMERS

Ronald R. Freeman Aug. 1965 19 p refs

(RIA-65-1904; AD-624891) CFSTI: HC $1.00/MF $0.50

Aminoquinone polymers of low molecular weight were synthesized from aliphatic, aromatic and disiloxane diamines with p-benzoquinones and 1,4 napthoquinones utilizing various polymerization techniques. No polymers could be formed from diamines and anthraquinones. The polymers were non-melting powders that were insoluble in conventional solvents but were generally soluble in formic and acetic acids, sulfuric acid and/or dimethylsufoxide. The thermal stability of these polymers was only fair as DTA and TGA analyses indicated initial decomposition in the 250–325° C range. In an oxygen flame, the polymers were reduced to ashes. TAB

N66-30565# Brandeis Univ., Waltham, Mass. Dept. of Chemistry.

HEATS OF SOLUTION OF ALKALI METALS IN AMMONIA

Thomas R. Tuttle, Jr., Charles Guttman, and Sidney Golden 15 Mar. 1966 17 p refs

(Contract Nonr-1677(01))

(TR-16; AD-630917) CFSTI: HC $1.00/MF $0.50

The heats of solution of sodium and potassium in liquid ammonia are examined in terms of the redox model which has been proposed for the composition of these solutions. The heats of solution are shown to vary in an essentially linear manner with the spin paramagnetic susceptibility of the solutions, as expected from the model. Analysis of the data yields enthalpy changes for the redox equilibrium $M^+ + 2S^- \rightleftarrows M^- + 2S$, which are in reasonably good agreement with those obtained from the temperature variation of spin paramagnetic susceptibility. A temperature-dependent enthalpy is indicated for the redox equilibrium. Author (TAB)

N66-30577# Iowa State Univ. of Science and Technology, Ames.

SPECTROPHOTOMETRIC STUDY OF THE REDUCTION OF METALS CONTAINING Cd(II) SALTS

Richard David Barnes (Ph.D. Thesis) Nov. 1965 56 p refs

(Contract W-7405-ENG-82)

(IS-T-36) CFSTI: HC $3.00/MF $0.50

The visible and uv absorption spectra of a series of molten salts of general type $Cd(II)Cl_x(AlCl_4)_{2-x}$ where $0 < x < 2$ were obtained at temperatures of 300–600°C. Absorption spectra of the same salts to which small amounts of Cd had been added were obtained at the same temperatures. These studies were undertaken in an effort to learn more about the state of the solute in metal–metal halide melts and the reason for the change in color on going from Cd–$CdCl_2$ (deep red) to Cd–Cd $(AlCl_4)_2$ (pale green-yellow). The spectra were recorded using a Cary 12 spectrophotometer with a furnace block-cell holder. Very short path lengths, down to 0.0073 cm, were acieved by using an insert in the standard 1 cm^2 cell. Concentrations of dissolved metal were in the range 0.00399–0.0160 M. The spectra of the unreduced melts consist of the steeply rising tail of an intense band extending to shorter wave lengths. The absorbance of this tail is 1.0 at 2570 Å for $Cd(AlCl_4)_2$ at 300° C, moving out to 3470 Å in $CdCl_2$ at 600°C. The reduced melts show (in addition to the solvent edge) a single intense band at 2900 Å ($\epsilon = 44,200$) for reduced $Cd(AlCl_4)_2$ at 300° changing to 3125 Å ($\epsilon = 16,700$) for the salt of composition $AlCl_3/CdCl_2 = 0.92$ at 550°. In $CdCl_2$ melts the solvent cutoff overlaps the solute band making resolution impossible. Both solvent and solute bands shift to the red with increasing temperature or with increasing chloride concentration. An electronic charge transfer process from the anion to the cation is postulated for the solvent band. NSA

N66-30582# Atomic Energy Commission Research Establishment, Lucas Heights (Australia).

THE RECOVERY OF BERYLLIUM OXIDE MATRIX FUELS THROUGH ITS OXYACETATE

M. S. Farrell, L. Szego, and P. B. Yates Jul. 1965 16 p refs

(AAEC/E-141)

The laboratory development of a process for the recovery and decontamination of beryllium from fuel processing solutions is described. Azeotropic distillation is used in converting aqueous beryllium solutions to beryllium oxyacetate. The beryllium oxyacetate is then purified by recrystallization. Using a feed solution containing 3 β-Curies of fission products per mole of beryllium, a decontamination factor of 3 to 4×10^3 can be obtained with a 90% recovery of beryllium. Some solubility and conductance data are given for beryllium oxyacetate and its hydrolysis products. The hydrolysis reaction is briefly discussed. Author (NSA)

N66-30588*# Miami Univ., Coral Gables, Fla.

THE SYNTHESIS, RESOLUTION AND CONFIGURATION OF β-HYDROXYVALINE

Jun-ichi Oh-hashi and Kaoru Harada [1966] 19 p refs Submitted for Publication *Its* Contrib. No. 054

(Grant NsG-689)

(NASA-CR-76232) CFSTI: HC $2.00/MF $0.50 CSCL 06A

DL-β-hydroxyvaline (III) was synthesized from sodium β,β'-dimethylglycidate by aminolysis with benzylamine followed by hydrogenolysis. N-benzoyl-DL-β-hydroxyvaline (IV) was resolved by use of (−)-α-methylbenzylamine to yield (−) N-benzoyl β-hydroxyvaline (VI). The configuration of VI was determined by converting it to methyl N-benzoyl-β-chlorovalinate (IX) and subsequent hydrogenolysis of IX yielded (−) methyl N-benzoylvalinate (X). From X, optically pure D-(−)-valine was obtained upon hydrolysis. Author

N68-30589*# Florida State Univ., Tallahassee.
THE CATALYTIC ACTIVITY OF THERMAL POLYANHYDRO-α-AMINO ACIDS FOR THE HYDROLYSIS OF *p*-NITROPHENYL ACETATE (CATALYSIS BY THERMAL POLYAMINO ACIDS)
Duane L. Rohlfing and Sidney W. Fox [1966] 18 p refs Presented in part at the 141st Meeting of the Am. Chem. Soc., Washington, D. C., Mar. 1962 Submitted for Publication *Its* Contrib. No. 067
(Grants NsG-105-61; NIH C-3971)
(NASA-CR-76240) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Thermally prepared polyanhydro-α-amino acids containing the eighteen amino acids common to protein accelerate the hydrolysis of *p*-nitrophenyl acetate. Such action is catalytic, rather than stoichiometric. Histidine residues play a key role in the hydrolysis; the contribution to activity of residues of lysine and arginine is minor, and no activity is observed for polymers containing no basic amino acids. All polymers tested were more active than the equivalent amount of histidine, some being more than ten times as active. The higher levels of activity, per unit of histidine, are observed with those polymers that contain a relatively low proportion of histidine. Author

N68-30590*# Florida State Univ., Tallahassee.
THE INACTIVATION OF CATALYTICALLY ACTIVE THERMAL POLYANHYDRO-α-AMINO ACIDS. (INACTIVATION OF THERMAL POLYAMINO ACIDS)
Duane L. Rohlfing and Sidney W. Fox [1966] 24 p refs Presented in part at the 141st Meeting of the Am. Chem. Soc., Washington, D. C., Mar. 1962 Submitted for Publication *Its* Contrib. No. 068
(Grants NsG-105-61; NIH C-3971)
(NASA-CR-76241) CFSTI: HC $1.00/MF $0.50 CSCL 06A

Thermally prepared polyanhydro-α-amino acids containing histidine catalyze the hydrolysis of *p*-nitrophenyl acetate. The more active preparations (histidine equivalent basis) are almost totally inactivated by heating in buffered solution. The hydrolysis of cyclic imide bonds, in which aspartic acid residues are initially bound, accompanies the inactivation by heat. Loss of activity is also observed when such imide bonds are hydrolyzed by treatment with alkali at room temperature. Related experiments, both with proteinoids (thermal polymers containing all amino acids common to protein) and compositionally simple copolymers of aspartic acid and histidine, indicate that the simultaneous presence in the same macromolecular preparation of histidine residues and imide linkages of aspartic acid residues is essential for the higher levels of activity observed. Author

N68-30593*# Miami Univ., Coral Gables, Fla.
STEREOSELECTIVE SYNTHESIS OF OPTICALLY ACTIVE ASPARTIC ACID FROM DERIVATIVES OF FUMARIC ACID AND MALEIC ACID
Kaoru Harada and Kazuo Matsumoto [1966] 35 p refs Submitted for Publication *Its* Contrib. No. 055
(Grant NsG-689)
(NASA-CR-76251) CFSTI: HC $2.00/MF $0.50 CSCL 07C

Optically active aspartic acid (4.5–15.4%) was synthesized by the amination of the the derivatives of fumaric acid and maleic acid with (S) and (R)-α-methylbenzylamine. Three kinds of reactions were carried out: (A) Reaction of (S) and (R)-α-methylbenzylamine [(S) and (R)-amine] with N,N'-di(S) and (R)-α-methylbenzyl fumaramide; (B) Reaction of (S) and (R)-amine with diethyl maleate; (C) Reaction of (S) and (R)-amine with diethyl fumarate. In each case, the reaction intermediates were isolated. To avoid the fractionation of the resulting optically active aspartic acid during the isolation and recrystallization procedures, a column chromatographic method for DNP-aspartic acid was employed. Possible steric courses of the reactions (A), (B), and (C) are discussed. Author

N68-30614*# Miami Univ., Coral Gables, Fla. Inst. of Molecular Evolution.
OPTICAL RESOLUTION AND CONFIGURATION OF TRANS-2,3-EPOXYBUTYRIC ACID
Kaoru Harada and Junichi Oh-hashi [1966] 16 p refs Submitted for Publication *Its* Contrib. No. 061 of the Inst. of Mol. Evolution
(Grant NsG-689)
(NASA-CR-76233) CFSTI: HC $1.00/MF $0.50 CSCL 07C

Results are presented for the optical resolution of epoxy acid (I) by brucine, and the configuration of the resolved trans-2,3-epoxybutyric acid is determined by treatment with benzylamine or ammonia. When the resulting N-benzyl allothreonine (IV) was hydrogenolyzed by using palladium on charcoal, the isolated amino acid was found to be optically pure allothreonine (V) and without any threonine or other amino acid. This suggests that amination proceeds with a typical S_N2 mechanism and no racemization occurs during the reaction. The reaction products of epoxy acid (III) and ammonia showed a large allothreonine peak and a small peak at about the alanine area in the automatic amino acid analyzer. Attempts to obtain optically active alpha-hydroxybutyric acid by reduction of epoxy acid (III) with sodium borohydride and by catalytic hydrogenation were unsuccessful. M.W.R.

N68-30620# International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Temperatures and Refractories.
BIBLIOGRAPHY ON THE HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF MATERIALS IN THE CONDENSED STATE, VOLUME 1966, NUMBER 1, JANUARY, FEBRUARY, MARCH 1966
J. J. Diamond, ed. (Natl. Bur. of Standards, Washington, D. C.) [1966] 76 p refs

The high temperature chemistry and physics of materials in the condensed state is covered in a bibliography taken from the literature in the United States and abroad. Properties of metallic, nonmetallic, and mixed materials are covered; as are devices for achieving, controlling, and measuring temperatures above 1500°C. Phase equilibria and reactions at temperatures above 1000°C are included. M.W.R.

N68-30627# Radio Corp. of America, Princeton, N. J. RCA Labs.
TRACE ANALYSIS OF SOLIDS BY MASS SPECTROMETRY Scientific Report No. 1, Apr. 1, 1965–Mar. 31, 1966
Richard E. Honig Apr. 1966 31 p refs
(Contract AF 19(628)-5106)
(AFCRL-66-322; AD-633305) CFSTI: HC $2.00/MF $0.50

The report covers work done to improve the performance of a mass spectrograph in the semi-quantitative analysis of solids. Reproducibility and accuracy were found to be limited by many instrumental factors, as well as sample inhomogeneity. A broad-based evaluation of highest-purity materials, to be used as compacting powders or counterelectrodes, has led to

at least one source which can supply gold of adequate purity. The design and construction of a short-pulse ion source was finished which is of particular value in surface studies. Ion-sensitive thin-film plates were developed which show marked improvements in line sharpness, halation, signal-to-noise ratio, and vacuum characteristics. Author (TAB)

N66-30635# Boston Univ., Mass. Dept. of Chemistry.
NON-DEGRADATIVE AND OTHER REACTIONS OF ACTIVE NITROGEN WITH ORGANIC SUBSTRATES Final Report, Sep. 1, 1961-Jan. 31, 1966
Norman N. Lichtin 31 May 1966 5 p refs
(Grant DA-ARO(D)-31-124-G171)
(AROD-3193-3; AD-633328) CFSTI: HC $1.00/MF $0.50

The reaction in the gas phase of active nitrogen produced by 2450Mc microwave-supported glow discharge with two types of organic substrate was investigated. One part of the research involved the reaction with conjugated dienes. The major aspect of this part was devoted to determination of the dependence of yields of seventeen different products as a function of the reaction parameters, ratio of reactants, total pressure, concentration of reactants and rate of linear transport. Kinetic analysis of these data provided insight into the mechanism of action of active nitrogen. The products of reaction of active nitrogen with isoprene under a single set of conditions were also investigated. The second part of the research involved investigation of the reaction of ^{14}C-labeled propylene with active nitrogen. Attention was directed to the activity present in propylene recovered after reaction with a large excess of active nitrogen. Both total activity and the activity at C-1 were determined. TAB

N66-30656# Peninsular ChemResearch, Inc., Gainesville, Fla.
SYNTHESIS AND POLYMERIZATION OF FLUORINATED SULFUR MODIFIED NITROSO RUBBER Quarterly Report, 1 Jul.-26 Nov. 1965
Eugene C. Stump, Ward H. Oliver, and Calvin D. Padgett 21 Dec. 1965 27 p
(Contract DA-19-129-AMC-152(N)(019116))
(QR-9; AD-633058) CFSTI: HC $2.00/MF $0.50

Terpolymer samples containing 3 and 6 mole percent $ONCF_2CF_2CO_2CH_3$ with CF_3NO and $CF_2{=}CF_2$ were prepared. A larger amount (280 g) of 1,1,2-trifluorobutadiene terpolymer with CF_3NO and $CF_2{=}CF_2$ was prepared. Terpolymers of $CF_2{=}CFCF_2NO$, $CF_2{=}CFCH_2CF_2CF_2CH_2CF{=}CF_2$ and $ONCF_2CF_2CF_2COOH$ with CF_3NO and $CF_2{=}CF_2$ were prepared. Attempted copolymerization of carbonyl fluoride and hexafluoroacetone with CF_3NO was unsuccessful. A 2-1. reactor equipped with stirrer and cooling coils has been procured and is being fitted with a refrigeration system. Author (TAB)

N66-30677# Linden Labs., Inc., State College, Pa.
CRYSTAL CHEMISTRY OF CERAMIC DIELECTRICS Second Summary Report (Final), 22 Dec. 1964-21 Jun. 1965
W. R. Buessem and P. A. Marshall, Jr. Apr. 1966 156 p refs
Its Rept.-24
(Contract DA-28-043-AMC-00170(E))
(ECOM-00170-F; AD-632788) CFSTI: HC $5.00/MF $1.00

Gradual changes in experimental and commercial TiO_2 and $BaTiO_3$ bodies upon application of dc-stresses at high temperatures were observed and measured during and after the test. The changes in resistivity are sometimes accompanied by changes in capacity, loss factor, and color. The current producing these changes has the features of an absorption current: it can be partly recovered; the discharge current can be measured over very long periods of time. Investigation of the effect of the electrode material on all changes occurring reveals that only the electrode material at the anode has an influence on the sign and on the rate of the change. Humidity has a very detrimental effect upon some dielectrics. Treatment in a humid atmosphere at 1000°C stores protons in some form in the material; these protons become activated during life test and produce rapid degradation. After removal from the dc life test, the changes produced by the dc stress disappear and the sample might recover completely, if the degradation damage has not been too severe. There are also chemical means to prevent the entering and migration of the two mobile defects: (1) the incorporation of fixed positive defects such as Nb^{5+}, U^{6+}, trivalent ions such as La^{3+} replacing Ba^{2+}, and monovalent F^- replacing O^{2-} and (2) second phases deposited or exsolved at the grain boundaries, such as $CaTiO_3$, BaO-2 TiO_2, $BaTiF_6$ or other fluorides. The great stability of the hot pressed, very pure, very dense $BaTiO_3$ suggests the role which certain impurities and closed pores might play in the degradation process. Author (TAB)

N66-30683# General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility.
X-IRRADIATION OF NORMAL SATURATED HYDROCARBONS Technical Report, 1 Oct. 1964-30 Sep. 1965
T. W. Albrecht and P. R. Cheever Kirtland AFB, N. Mex., AF Weapons Lab., May 1966 34 p refs
(Contract AF 29(601)-6643)
(AFWL-TR-66-3; FZK-272; AD-632666) CFSTI: HC $2.00/MF $0.50

The development of trans-vinylene in X-irradiated octacosane and Marlex 6002 polyethylene films was measured by means of the infrared spectrometer. Initial development of the trans-vinylene in the octacosane films at temperatures of 137°, 229°, and 289°K had a G-value of 2.1±0.4 bonds formed per 100 eV, with decay of the trans-vinylene being most rapid at the highest temperature. Hydrogen evolution from X-irradiated films of these same materials was measured by means of the mass spectrometer. The evolution showed a decrease as the temperature of the irradiation was decreased below 194.5°K with practically no hydrogen liberation at liquid-nitrogen temperature. When the cold irradiated films were slowly warmed, they released a burst of hydrogen at approximately 194.5°K. The amount of hydrogen liberated in the burst was dependent upon the irradiation temperature and the irradiating time. EPR (electron paramagnetic resonance) spectra of the free radicals in irradiated Marlex 6002 polyethylene were predominantly of seven lines centered at G=2.003 and spanning 120 gauss. Author (TAB)

N66-30688# Coating and Chemical Lab., Aberdeen Proving Ground, Md.
EFFECT OF WATER ON HYDRAULIC BRAKE FLUID Interim Report
Charles B. Jordan May 1966 20 p refs
(CCL-198; AD-633035) CFSTI: HC $1.00/MF $0.50

A study was made to determine the effect of absorbed moisture on the physical and chemical characteristics of polar type hydraulic brake fluids. Specific studies were carried out on the effect of moisture on equilibrium boiling point, flash point, cold temperature viscosity, oxidation stability, and effect on rubber with several polar brake fluids

of varying chemical composition. Moisture produced the following effects: (a) Boiling points are lowered in all brake fluids. (b) Flash points are increased. (c) Cold temperature viscosities are usually increased. (d) The stability of the brake fluid toward oxidation is decreased. (e) Rubber swelling and softening is decreased. Author (TAB)

N66-30708# General Dynamics/Fort Worth, Tex. Nuclear Aerospace Research Facility.
EXCITATION OF HYDROGEN CYANIDE, METHYL CYANIDE, ETHYL CYANIDE, AND BUTADIENE BY LOW-ENERGY ELECTRON IMPACT Technical Report, 1 Oct. 1964–30 Sep. 1965
C. R. Bowman Kirtland AFB, N. Mex., AF Weapons Lab., May 1966 24 p refs
(Contract AF 29(601)-8643)
(FZK-281; AFWL-TR-66-37; AD-632965) CFSTI: HC $1.00/MF $0.50

The excitation spectra of hydrogen cyanide, methyl cyanide, ethyl cyanide, and butadiene were measured by the trapped electron technique. These spectra are compared with ultraviolet absorption data where possible and with the excitation spectra of isoelectronic molecules of the acetylene series. Author (TAB)

N66-30738# Battelle Memorial Inst., Columbus, Ohio.
MEASUREMENT OF TRUE SURFACE AREA IN ELECTRODES Final Technical Documentary Report, 15 Dec. 1964–15 Feb. 1966
J. Mc Callum, R. W. Hardy, and R. F. Redmond Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Apr. 1966 102 p refs
(Contract AF 33(615)-2225)
(BATT-7138; AFAPL-TR-66-31; AD-632729) CFSTI: HC $3.00/MF $0.75

Double-layer capacitance measurements were selected as a means to measure true surface areas. When a constant-current pulse is applied to the double layer capacitance inside a pore, the change of voltage is usually observed to be nonlinear with time. This report provides experimental verification of theoretical predictions by others on how such a voltage transient is related to the geometric dimensions of the pore, the electrolyte resistivity, and the double-layer capacitance. New theoretical work shows a capacitance charging curve will become linear with time (a) for a single uniform pore, (b) for multiple pores of uniform shape, with or without mixed dimensions, and (c) for finite multiple pores with any shape. Faradaic current is shown to have negligible effect if that reaction current is constant and small relative to the capacitance charging current. Measurements on porous carbon and sintered nickel plaques give areas from 20 to 80% of BET values. Thus, a substantial part of the surface of these electrodes appears to be unwetted. Author (TAB)

N66-30744# Aktiebolaget Atomenergi, Stockholm (Sweden).
A SIMPLE APPARATUS FOR FAST ION EXCHANGE SEPARATIONS
K. Samsahl Sep. 1964 19 p refs
(AE-159) CFSTI: HC $1.00/MF $0.50

An apparatus suitable for very fast ion exchange group separations in radiochemistry has been elaborated. The apparatus which consists of a system of glass tubes with pistons driven by the same force, allows the exact adjustment of influent solutions to a long series of ion-exchange columns. The practical application of the apparatus to the simultaneous separation of six groups of trace elements in the neutron activation analysis of biological material is described. Author

N66-30774# Parametrics, Inc., Waltham, Mass.
DEVELOPMENT OF KRYPTON-85 AS A UNIVERSAL TRACER. EXTENSION OF PHASE III: AREAS OF APPLICATION, NOVEMBER 1, 1963–OCTOBER 31, 1964
David Chleck, Richard Maehl, and Orlando Cucchiara Feb. 1966 62 p refs
(Contract AT(30-1)-2757)
(NYO-2757-5) CFSTI: HC $3.00/MF $0.75

The direct application of kryptonates to a number of important problem areas was further substantiated and/or explored. Methods for preparing kryptonates were extended. Homogeneous kryptonation, i.e., uniform kryptonation in depth, was achieved by varying the kryptonation conditions. By noting the point of activity release on reheating a temperature stabilized sample, the maximum surface temperatures attained by various kryptonated solids were measured. The accuracy was found to be limited only by the independent temperature measurement, (thermocouples) at temperatures up to about 2000°F. The use of kryptonates to determine trace water in organic liquids was developed further. The feasibility of a method for aqueous sulfate ion analysis via release of krypton-85 from kryptonated barium carbonate in a saturated barium carbonate solution was demonstrated. Krypton-85 release from kryptonated wires subjected to tensile stress in both air and inert atmosphere provided evidence of oxidation during the creep of these materials. The detection of corrosion in aqueous salt solution via loss in activity of kryptonated aluminum was demonstrated as was a means of testing a corrosive resistant coating (paint) by krypton-85 release from a kryptonated substrate (iron) under controlled environment. Author (NSA)

N66-30776# Hanford Atomic Products Operation, Richland, Wash. Plutonium Chemistry Lab.
CERAMIC CELLS AND ACCESSORIES FOR ELECTROWINNING AND ELECTROREFINING OF PLUTONIUM METAL
R. S. Rosenfels 17 Dec. 1965 33 p refs
(Contract AT(45-1)-1350)
(RL-SEP-824) CFSTI: HC $2.00/MF $0.50

The design, method of fabrication, properties, and operating behavior are given for four continuous electrowinning and two batch electrorefining cells made of a ceramic body composed of 6 mole % Mg_2TiO_4 and 94 mole % MgO. A stirrer, made of the same material and required for batch refining cells, is also described. The ceramic components developed have proven satisfactory in complete, operating, equipment assemblies found effective in the winning and refining of plutonium metal by electrolytic deposition in molten salt. Author (NSA)

N66-30778# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
THE OXIDATION AND IGNITION OF PLUTONIUM
M. A. Thompson 21 Mar. 1966 17 p refs
(Contract AT(29-1)-1106)
(RFP-491) CFSTI: HC $1.00/MF $0.50

The oxidation rates of plutonium metal at temperatures between 25° and 450° C were measured in air having a dew-point of about 8°C. A change in slope of the rate curve was noted at the alpha to beta phase transformation. A decrease in the rate

above 350°C, with a minimum at 400°C was confirmed. This is thought to be associated with properties of the resulting oxide. Plutonium was found to ignite in air at temperatures between 310° and 505°C. Exotherms were observed in the heating curve at 200° and 400°C. Metallographic results suggest accelerated oxidation at the exotherm temperatures. This initial accelerated oxidation may produce a more protective oxide causing a long-term rate decrease. Decreases in the oxidation rates were observed at temperatures above the exotherm temperatures. It is thought that the oxides formed at these temperatures are more protective and thus decrease the corrosion rate. The reaction rate of plutonium with water vapor showed a more definite plateau at 100° and 200°C than the rate in air. Differences in oxide properties as influenced by the moisture content of the oxidizing atmosphere were again suggested. A positive correlation was made between the particle size and formation temperature. Author (TAB)

N66-30799*# California Univ., San Diego. Dept. of Chemistry.

[ANALYSIS OF THE ORGANIC AND INORGANIC CONSTITUENTS OF CARBONACEOUS AND OTHER SELECTED STONY METEORITES] Semiannual Status Report, 1 Nov. 1965–1 May 1966

Harold C. Urey and Bartholomew Nagy 12 Jul. 1966 6 p
(Ns G-541)
(NASA-CR-76331) CFSTI: HC $1.00/MF $0.50 CSCL 08D

An analytical procedure was developed by which the high molecular weight, insoluble substances in coal and kerogen, and the insoluble polymer-like meteorite organic matter were degraded oxidatively and the resultant products isolated and characterized. The procedure uses ozonolysis and alkaline hydrogen peroxide oxidation. Methyl ester derivatives of the oxidation products were prepared using diazomethane prior to preparative vapor phase chromatography. Individual components were subjected to mass spectrometric, infrared, and ultraviolet analysis. The procedure is suitable for analyzing micro-quantities of samples. Studies continued on the optical rotatory dispersion of soil, marine sediment, sedimentary rock, and carbonaceous meteorite lipids, and the results are briefly discussed. R.N.A.

N66-30828# Tokyo Univ. (Japan). Inst. for Solid State Physics.

DISTRIBUTION OF SPALLATION PRODUCED CHROMIUM BETWEEN ALLOYS IN IRON METEORITES

Masako Shima and Masatake Honda Sep. 1965 32 p refs Submitted for Publication
(NP-15591)

Chromium nuclides produced by cosmic rays were measured mass-spectrometrically in iron meteorites. A surface ionization method was applied, with chromium finally isolated from the samples by a solvent extraction method. A marked enrichment of ^{54}Cr and ^{53}Cr could be observed. Sulfuric acid dissolved a bulk of meteorite selectively, leaving a small residue of a nickel-rich metal phase, which contained relatively high concentrations of natural chromium. An isotopic dilution analysis using enriched ^{50}Cr or ^{52}Cr was made to obtain absolute contents of those nuclides. In the cases of Grant and other meteorites, the nickel-rich (taenite-rich) fraction was found to contain a higher concentration of these products than the nickel-poor (kamacite-rich) fraction, which was readily soluble in acid. The overall contents of ^{54}Cr were found to be in the range of 13 to 25 ppb in several meteorites, and the ratios $^{50}Cr:^{53}Cr:^{54}Cr$ were found always to be approximately 0.2:1:1 respectively. The enrichment of these chromium nuclides in taenite was confirmed by several methods. The interpretation of this phenomenon was discussed from a cosmochemical viewpoint. Author (NSA)

N66-30833# Soreq Research Establishment, Israel Atomic Energy Commission, Yavneh.

REACTIONS OF THE HYDRATED ELECTRON

M. Anbar May 1965 45 p refs
(IA-1041)

The reactions of hydrated electrons with inorganic and organic compounds are reviewed. The rates of these reactions as well as the reaction products are discussed. It is shown that the reactivity of a compound toward e_{aq}^- is a function of the availability of a vacant orbital which is capable of accommodating an additional electron. The products of these reactions, which contain an additional electron, always have a finite lifetime, even if they are only short-lived intermediates. (126 references are cited.) Author (NSA)

N66-30839# Atomics International, Canoga Park, Calif.

X-RAY DIFFRACTION DATA FOR ZrC-ZrH_2

William L. Korst 10 July 1965 5 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11542) CFSTI: HC $1.00/MF $0.50

The ternary compound ZrC-ZrH_2 was prepared by heating powdered ZrC and ZrH_2 in a hydrogen atmosphere, confirming earlier reports of its existence. The hexagonal lattice constants were determined to be: $a_0=3.3467\pm0.0001$ Å, $c_0=5.4898\pm0.0001$ Å, $c/a=1.640$. A listing of the X-ray diffraction powder pattern is given. Author (NSA)

N66-30916# Iowa State Univ. of Science and Technology, Ames.

SEPARATION OF CADMIUM FROM THE LEAD–BISMUTH EUTECTIC BY HIGH VACUUM SINGLE-STAGE DISTILLATIONS: CHAMBER DESIGN AND DISTILLATE PURITY

Lawrence B. Murdock and George Burnet Mar. 1966 28 p refs
(Contract W-7405-ENG-82)
(IS-1329) CFSTI: HC $2.00/MF $0.50

A distillation chamber was evaluated to determine its effectiveness for separating liquid metals by a continuous high vacuum distillation process. The chamber had an integral condenser which was cooled by a sodium–potassium eutectic. The metal to be separated flowed down an inclined distribution plate, opposite the condenser. Partial separation of cadmium from the lead–bismuth eutectic was achieved, however distillate purity was found to be low. The cause of the low purity was investigated and found to be short-circuiting of liquid metal from the distribution plate to the distillate receiver. Chamber design changes are recommended. Author (NSA)

N66-30926# Rhode Island Univ., Kingston. Graduate School of Oceanography.

ISOTOPIC ABUNDANCE STUDIES BY NEUTRON ACTIVATION ANALYSIS Annual Report, 15 Apr. 1965–14 Apr. 1966

James T. Corless [1966] 14 p refs
(Contract AT(30-1)-3369)
(NYO-3369-6) CFSTI: HC $1.00/MF $0.50

A sensitive and reliable technique based on neutron activation analysis was developed for the determination of variations in the relative abundance of ^{48}Ca in nature. It was also found that measurable variations in the relative abundance of ^{48}Ca do exist. NSA

N66-30935# Lyon Univ. (France). Institut de Physique Nucleaire.

ACTIVATION ANALYSIS OF A MIXTURE OF RARE EARTHS [ANALYSE PAR ACTIVATION D'UN MELANGE DE TERRES RARES]

Andre Sautin (M.S. Thesis) Dec. 1965 84 p refs In FRENCH (LYCEN-6538)

The determination of rare earths by activation analysis when they form the major constituent of the sample is reported. In the samples used, the proportion of each rare earth varied considerably from one element to the other—from at least 40% to less than 1%. Two types of samples were used. The first was a mixture used as a primary catalytic material under the name of didymium oxide or didymium and consists of a mixture of rare earth oxides with the approximate concentration neodymium oxide 50 to 55%, praseodymium oxide 12 to 15%, and traces of lanthanum and cerium. The second sample was a catalyst of silica or alumina support impregnated by a solution of didymium and other elements among which were copper and potassium. The results of determinations made on didymium by the irradiation of deposits on paper or of solid samples are given. Spectrum of the ensemble of radioisotopes formed during irradiation was obtained by γ spectrometry. Direct analysis was used to determine lanthanum and neodymium. The results showed that thermal neutron activation can be used for the identification and determination of rare earth elements present at very different ratios as in the mixture used. A precision of 3% could easily be attained. NSA

N66-30940# Mellon Inst., Pittsburgh, Pa. Radiation Research Labs.

[RADIATION RESEARCH] Quarterly Report, Jul. 1–Sep. 30, 1965

8 Oct. 1965 10 p *Its* Fundamental Res. No. 6041
(Contract AT(30-1)-2310)
(RRL-2310-164) CFSTI: HC $1.00/MF $0.50

Abstracts are presented of reports on the ESR spectrum of FO_2 radical formed in electron irradiation of CF_2 in presence of O_2, ESR studies of radioinduced radicals, and kinetics of reaction of radicals with HI. The radiolysis of liquid CH_4 and the effects of propene and C_2D_4 on the product yields were studied. Hydrogen yields in irradiated liquid Ar–C_2H_4 and C_2H_4 at −161°C are reported. Work on the direct photolysis of ethylene gas is described. Results of runs on the flash photolysis of C_2H_6 in the far uv are given. The mercury ($^1P_1$) photosensitized decomposition of methylcyclopropane and recombination coefficients for the ions produced in irradiated alkanes and alkenes are reported briefly. During the pulse radiolysis of solutions of $HClO_4$–$Fe(ClO_4)_3$, a transent absorption which formed at 345 mμ with a half life of 45 μsec was determined to be due to reaction of Fe^{3+} ion and OH radical. NSA

N66-30945# Naval Radiological Defense Lab., San Francisco., Calif.

RADIONUCLIDE FRACTIONATION IN AIR-BURST DEBRIS

E. C. Freiling and M. A. Kay 20 Sep. 1965 13 p refs
(Contract AT(49-7)-1963)
(USNRDL-TR-933) CFSTI: HC $1.00/MF $0.50

Radiochemical data from fractionated samples from 15 airbursts provided a source of equivalent-fission values for 24 radionuclides. The airbursts ranged in yield by a factor of over 300. The equivalent-fission values were converted to ratios based on ^{95}Zr and these ratios were correlated logarithmically. The correlation slopes were found to be relatively insensitive to yield and their values permitted the placement of the radionuclides on a scale of volatility. Several groups of radionuclides which did not fractionate from each other were found. The nuclides ^{137}Cs and ^{140}Ba had essentially the same slopes for air bursts as for high-yield surface bursts, but ^{99}Mo and ^{239}Np behaved more volatiley in the air bursts. Finally, the volatility inferred from fractionation behavior correlated well with that based on thermodynamic calculations. Author (NSA)

N66-30983# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

SOLID-STATE EQUILIBRIA IN THE SYSTEMS LITHIUM–CARBON AND LITHIUM–BORON

D. R. Secrist [1965] 7 p refs Presented at the Am. Ceramic Soc. Conf., Washington, D. C.
(Contract W-31-109-ENG-52)
(CONF-660505-1) CFSTI: HC $1.00/MF $0.50

A partial study of the phase relations existing in the systems lithium–carbon and lithium–boron was conducted at 2–4 atm pressure. Phases present in the 3 to 50 at. % lithium region of the system lithium–carbon to 700°C consisted of carbon and stoichiometric Li_2C_2. A single crystal of Li_2C_2 was examined by the Weissenberg X-ray method; the unit cell was identified as primitive monoclinic. A lithium boride phase corresponding to LiB_{12} was synthesized in the 9 to 50 at. % lithium region of the system lithium–boron. The reaction of lithium with B_4C was also considered. Author (NSA)

N66-30994# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.

SPARK-SOURCE MASS SPECTROMETRIC ANALYSIS OF COMMON AND RADIOGENIC LEAD

J. C. Franklin and E. B. Griffin 25 Feb. 1965 10 p
(Contract W-7405-ENG-26)
(Y-1481) CFSTI: HC $1.00/MF $0.50

Spark-source mass spectrography was utilized to provide a method of analysis that is fast and has extremely low levels of detection for more than forty elements that may be present in lead. Author (NSA)

N66-31005# Pennsylvania State Univ., University Park. Dept. of Chemistry.

RADIATION CHEMISTRY STUDIES OF SILANE Annual Progress Report

F. W. Lampe, G. G. Hess, and J. F. Schmidt 5 Apr. 1966 25 p refs
(Contract AT(30-1)-3570)
(NYO-3570-2) CFSTI: HC $1.00/MF $0.50

Ion-molecule reactions and radiolysis reactions in silane were studied. Pressure and delay-time dependencies of the intensities of ions present in silane, (ionized by 50-ev electrons) were examined over the ranges of 3 to 12×10^{-3} torr and 0 to 1 μsec. Appearance-potential studies of the $Si_2O_4^+$ ion were conducted using the retarding potential-difference method. Data on secondary ions of monosilane, ionic reactions, and mass spectra of Si_2H_6 are tabulated. Silane was exposed to gamma radiation from a 25,000°C ^{60}Co source at a dose rate of 1.50×10^{12} ev/cm^3-sec. The products were analyzed quantitatively by gas chromatography and qualitatively by mass

spectrometry. Three products were found: H_2, Si_2H_6 and SiH_4. It is believed that the key to the polymerization and hydrogen production lies in the ion-molecule reactions. NSA

N66-31012# Los Alamos Scientific Lab., N. Mex.
THE HIGH-TEMPERATURE CHEMISTRY OF NON-FISSIONABLE CERAMICS
Melvin G. Bowman [1966] 17 p refs Presented at the Am. Ceramic Soc. Meeting, Washington
(Contract W-7405-ENG-26)
(LA-DC-7784; CONF-660505-2) CFSTI: HC $1.00/MF $0.50

The high temperature chemical properties of typical refractory compounds are discussed in the framework of the performance that might be expected under the extreme conditions of environment and temperature which will be experienced by components of different types of space vehicles. A brief review is given of some of the newer techniques for determining high temperature phase relationships and thermochemical parameters, particularly partial molal quantities. Author (NSA)

N66-31018# Princeton Univ., N. J.
THE RADIOLYSIS OF LITHIUM NITRATE
Thomas G. Ward, Jr. (Ph.D. Thesis) Mar. 1966 193 p refs
(Contract AT(30-1)-238)
(TID-22796) CFSTI: HC $5.00/MF $1.00

The radiolysis of both molten and crystalline lithium nitrate was investigated under experimental conditions that differed widely in dose rate, linear energy transfer (LET), and temperature. Radiolysis of the crystalline salt was effected by the energetic recoil particles of the $^6Li(n,a)^3H$ reaction. Samples of molten $LiNO_3$ were irradiated in a reactor at 270°C and by ^{60}Co γ rays at dose rates that varied by a factor of 60. In every case, nitrite ion and molecular oxygen were the only significant decomposition products; they appeared approximately in the ratio of 2 to 1 as implied by the stoichiometry of the reaction $LiNO_3 \rightarrow LiNO_2 + 1/2\ O_2$. In the solid, the decomposition was linear with an initial 100-ev yield, $G_0(NO_2^-)$, of 0.22 ± 0.1. For the melt irradiated by the ^6Li recoil particles at 5.2×10^{21} ev/mole-min, $G_0(NO_2^-) = 5.5 \pm 5$, and a steady-state nitrite ion concentration was indicated at about 3.1 mole % nitrite. Similar observations were made in the γ irradiations with $G_0(NO_2^-) = 3.73 \pm .05$ and steady states falling between 0.02 and 0.23 mole percent nitrite. There were indications that nitrite ion itself was not appreciably radiolyzed. A 3-fold variation in the dose rate had no effect on the ^6Li recoil irradiation of the solid; the dose rate of the corresponding molten salt irradiations was constant. In the γ exposures, however, the steady-state nitrite levels passed through a maximum as the dose rate increased from 8.9×10^{18} to 5.6×10^{20} ev/mole-min. The 10-fold increase in $G_0(NO_2^-)$ between radiolysis by ^{60}Co γ rays and ^6Li recoil particles in the solid (γ-ray data taken from the literature) was attributed exclusively to the large increase in LET; the 50% increase in $G_0(NO_2^-)$ and the marked increase in the steady state for the molten salt were also attributed to this factor. The primary effect of the solid–liquid phase transition was the 25-fold increase in $G_0(NO_2^-)$ for ^6Li recoil radiolysis and the nearly 200-fold increase for ^{60}Co γ rays. Mechanisms for the reactions are discussed. NSA

N66-31023# Paris Univ. (France). Laboratoire Curie.
METHOD OF ANALYZING THE ACTIVITY PROFILE OF A RADIOCHROMATOGRAPH [METOD D'ANALYSE DU PROFIL D'ACTIVITE D'UN RADIOCHROMATOGRAMME]
S. Apelgot and M. Duquesne Brussels, EURATOM, 1966 28 p refs In FRENCH
(Contract EURATOM-030-63-3 BIOF)
(EUR-2626.f)

A study of the activity profile of a radioactive solute at various stages of chromatography shows, with a pure substance, a Gaussian distribution and makes it possible to determine a law, governing the standard deviation broadening in that distribution. In a mixture, each constituent has a Gaussian activity curve, and a complex profile can be broken down into a sum of Gaussian curves. Author (NSA)

N66-31025# Commissariat a l'Energie Atomique, Saclay (France). Service of de Physico-Chimie Appliquee.
TECHNOLOGICAL STUDY ON POLYPHENYLS [ETUDE TECHNOLOGIQUE DES POLYPHENYLES]
J. R. Puig, A. Houillier, D. Rosier (PROGIL), and F. Romano (EURATOM) Brussels, EURATOM, 1965 174 p refs In FRENCH Prepared jointly with PROGIL
(Contracts EURATOM-013-60-12 ORGF; EURATOM-015-60-12 ORGF)
(EUR-2401.f)

The results of thermal and radiolytic decomposition studies of terphenyls obtained in ampoules are reported. Pyrolysis was studied at temperatures between 416° and 530° C and radiolysis at temperatures around 350° C. The calorimetric dosimetry of the mixed radiations was investigated and a description is given of the construction of a dosimeter derived from the Calvet microcalorimeter. Finally, the average unit-volume gamma-ray and fast-neutron fluxes in the irradiation volume of an in-pile loop (BLO 3) were determined on a mock-up by means of graphite isothermal calorimeters and activation detectors. Author (NSA)

N66-31035# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
CHEMICAL EFFECTS OF ELECTRIC DISCHARGES OF MILLISECOND DURATION IN FRICKE DOSIMETERS [EFEKTY CHEMICZNE MILISEKUNDOWYCH WYLADOWAN ELEKTRYCZNYCH W DOZYMETRZE FRICKE'GO]
Zbigniew P. Zagorski and Jan Grodkowski Dec. 1965 18 p refs In POLISH; ENGLISH summary
(INR-673/17/C)

Electric discharges of millisecond duration submerged in liquid phase were used as the energy source to generate intermediate species similar to those generated by irradiation in Fricke dosimeters. The energy was determined calorimetrically. The iron (III) yield was found to be G=0.3 −0.5. Several analogies were found between the effects of electric discharge and radiation on the Fricke dosimeter. NSA

N66-31039# Los Alamos Scientific Lab., N. Mex.
DIFFUSION OF CARBON IN NIOBIUM AND TITANIUM CARBIDE
A. V. Shcherbedinskaya and A. N. Minkevich [1965] 6 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved. Tsvetn. Met. (Dzaudzhikau), v. 8, no. 4, 1965 p 123–125
(LA-TR-66-21) CFSTI: HC $1.00/MF $0.50

The diffusion coefficients for C in NbC at 1100° to 1500°C and in TiC at 900° to 1200°C were determined. The activation energy for diffusion of C in TiC was higher than that for C in NbC. NSA

N66-31046# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DETERMINATION OF HYDROGEN IN BERYLLIUM [DOSAGE DE L'HYDROGENE DANS LE BERYLLIUM]
Jacques Sannier and Janine Leroy Mar. 1966 15 p refs In FRENCH
(CEA-R-2957)

A method was developed for determining hydrogen content in beryllium by vacuum extraction at 1150°C in a molten copper bath. Under these conditions, hydrogen evolution is relatively rapid. The results showed that this method has both an excellent sensitivity (on the order of a few parts per million) and good reproducibility. Author (NSA)

N66-31047# Louisiana State Univ., New Orleans. Dept. of Chemistry.
STUDIES ON THE USE OF SALICYLIC ACID AND THE SALICYLATE ION AS LIQUID SCINTILLATORS Appendix II. Annual Progress Report No. 7
Charles A. Scott (M.S. Thesis) Jan. 1966 56 p refs Presented at Am. Chem. Soc., Southeast-Southwest Regional Meeting, Memphis, 2–4 Dec. 1965
(Contract AT(40-1)-2576)
(CONF-651214-1) CFSTI: HC $3.00/MF $0.50

Ionized salicylic acid was found to be an effective single solute in the liquid scintillation counting of ^{241}Am and ^{210}Po. The effect of concentration was studied as well as the quenching effect of methanol, dimethylformamide, and dimethylsulfoxide. The excitation and emission spectrum were found to be in the region of S-11 response. Although methanol and dimethylformamide were found to quench the scintillator output, they still proved useful in enhancing the dissolution of aqueous samples. Solvent extraction with subsequent determination of the distribution of ^{241}Am by liquid scintillation counting of the alpha activity was performed with good results. Author (NSA)

N66-31051# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
CALCIUM-ACTIVATED BARIUM SULFATE AS SORBENT OF RADIOSTRONTIUM. II. THE ACTIVATION BY THE HEAT TREATMENT OF THE MIXTURE OF BARIUM AND CALCIUM SULFATES [AKTIVEROVANNYI SERNOKISLYI BARII KAK SORBENT NEBOLSHIKH KOLICHESTV. II. AKTIVIROVANIE SERNOKISLOGO BARIYA PUTEM SPEKANIYA EGO S SERNOKISLYM KALTSIEM]
L. Berak and J. Muenich 1965 58 p refs In CZECHOSLOVAKIAN; ENGLISH summary
(UJV-956/63)

A highly selective sorbent for Sr^{2+} and Ra^{2+} based upon for forcible introduction of $CaSO_4$ flaws into the $BaSO_4$ lattice by sintering a mixture of both sulfates is proposed. Elementary problems of synthesis and strontium capture are discussed. Author (NSA)

N66-31059# Alabama Univ., University. Dept. of Physics.
STUDY OF INTERACTIONS BETWEEN f-SHELL TRANSITION IONS IN NON-METALLIC CRYSTALS Final Report, 15 Feb. 1963–15 Sep. 1965
15 Sep. 1965 9 p refs
(Contract AT(40-1)-3090)
(TID-22848) CFSTI: HC $1.00/MF $0.50

Two techniques were used to study the super exchange between f-shell ions: ESR of ion pairs located in a diamagnetic lattice; and NMR (and quadrupole) of the components in the super exchange path. The ^{35}Cl pure quadrupole frequencies were measured from the free induction decays for a number of rare earth chlorides isomorphic to $LaCl_3$ NSA

N66-31061# Pennsylvania State Univ., University Park. Dept. of Metallurgy.
TRANSFORMATIONS IN AB_2 INTERMETALLIC COMPOUNDS Progress Report, 1 May. 1965–28 Feb. 1966
Earle Ryba 1 Mar. 1966 17 p refs
(Contract AT(30-1)-3560)
(NYO-3560-3) CFSTI: HC $1.00/MF $0.50

Complete determinations of the crystal structures of $YbZn_2$, $HoZn_2$ and $TmZn_2$ were carried out by X-ray diffraction techniques. From the crystallographic data, which are tabulated, the coordination number of the Ar atom in each compound was determined to be 16. An analytical procedure for the calculation of these domains was formulated, and subsequently used to obtain the domain of the Ar atom in 9 other $CeCu_2$-type compounds. It was also found that the $CeCu_2$-type structure is a structure in which the atom positions can shift, in a predictable way, to allow for changes in relative atom sizes. All $REZn_2$ (RE=rare earth) compounds were prepared and thermal analysis obtained on each. The change in melting point as the rare earth element is changed closely follows the variation in melting points among the rare earth elements themselves. Thermal arrests in these alloys are discussed. NSA

N66-31067# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
A STATISTICAL THERMODYNAMIC MODEL FOR NONSTOICHIOMETRIC UO_2
E. A. Aitken and R. E. Fryxell Mar. 1965 13 p refs Presented at the Am. Ceram. Soc. Ann. Meeting, Philadelphia, 3–5 May 1965
(Contract AT(40-1)-2847)
(GE-TM-65-4-4; CONF-650513-8) CFSTI: HC $1.00/MF $0.50

A statistical model was established for UO_2 in which oxygen ions occupy either normal lattice sites or interlattice sites. The relationship between the partial molar free energy of oxygen and the composition for a given temperature was derived and applied to experimental data. The model requires the determination of four energy parameters to fit the experimental results, one of which is the Frenkel energy. A Frenkel energy of 60 kcal/g atom of O was obtained using available experimental data in the oxygen excess region and some new data in the oxygen deficient region. The new data were obtained at 2400°C from free vaporization of UO_2 in atmospheres in which the oxygen partial pressure was controlled by varying the water to hydrogen ratio. The UO_2 tends toward a limiting or congruent vaporization composition which is a function of the water to hydrogen ratio in the atmosphere. Author (NSA)

N66-31078# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
STUDY OF SOME PROPERTIES OF ZIRCONIUM PHOSPHATE [ETUDE DE QUELQUES PROPRIETES DU PHOSPHATE DE ZIRCONIUM]
Jacques Prospert (Ph.D. Thesis—Paris Univ.) 1966 62 p refs In FRENCH
(CEA-R-2835)

Zirconium phosphate was studied for possible use as an ion-exchanger; the first objective was to develop a reproducible method of preparation. To this end, several tests were carried out varying the molar ratios of phosphorus and of zirconium. Some physical properties such as X-ray diffraction were also examined, along with certain chemical properties, particularly the percentages of free water and structural water given by the loss on calcination, the Karl–Fisher method, and weight loss by thermogravimetry. Finally an attempt was made to apply the exchanger to the separation of alkaline ions. The static tests showed that the order of fixation of these ions was $Cs^+ > Rb^+ > K^+ > Na^+$. Tests with columns showed that Na^+ and K^+ were easily separable, as was the Rb^+–Cs^+ mixture, the last pair being fairly difficult to dissociate.

Author (NSA)

N66-31079# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

SPECTROGRAPHIC DETERMINATION OF SMALL QUANTITIES OF BORON IN IRON AND STEELS BY MEANS OF A PREDISPERSIVE SPECTROMETER [DOSAGE SPECTROGRAPHIQUE DE PETITES QUANTITIES DE BORE DANS LE FER ET LES ACIERS A L'AIDE DU SEPARATEUR D'ORDRES]

Danh Tran Van, and Jacques Ernoult Jan. 1966 15 p refs In FRENCH

(CEA-R-2914)

Small quantities of boron in iron and steels were determined by means of a spectrographic method using a predispersive spectrometer. Samples containing more than 5 ppM of boron can be analyzed with standard deviation of about 10%.

NSA

N66-31080# Aerojet-General Nucleonics, San Ramon, Calif.

FISSIOCHEMICAL DEVELOPMENT PROGRAM Monthly Progress Report, Oct. 1965

Nov. 1965 18 p ref

(Contract AT(04-3)-596)

(AGN-8169) CFSTI: HC $1.00/MF $0.50

Developments in studies on: energy deposition from 20 wt % U–Pd alloy fission fragment–fuel interaction; fission fragment irradiations of nitrogen–methane mixtures; nitrogen atom yields in radiolysis of nitrogen systems; preparation and stability of fibrous fissiochemical fuels; fissiochemical synthesis; and process design and economics are reported.

Author (NSA)

N66-31081# European Atomic Energy Community, Brussels (Belgium).

MASS SPECTROMETRIC STUDIES ON POLYPHENYLS. PART II: THE MASS SPECTRA OF THE TRIPHENYLBENZENES AND TRIPHENYLENE

S. Facchetti, A. Copet, and W. Beyrich 1966 20 p refs

(EUR-2713.e)

The 70 and 50 ev mass spectra of the three triphenylbenzenes and triphenylene, obtained with an Atlas CH4 Mass Spectrometer, are reported and discussed. As observed for some polyphenyls previously studied, the ortho bonded molecules are characterized by a lower stability under electron impact leading to a greater fragmentation by rupture of C–H and C–C bonds. Triphenylene behaves like other condensed aromatic hydrocarbons showing a higher stability and a specific fragmentation. From their mass spectra, previsions are made on gas formation in the radiolysis of these molecules.

Author (NSA)

N66-31095# Commissariat a l'Energie Atomique, Fontenay-Aux-Roses (France).

MEASUREMENT OF THE DISSOCIATION PRESSURE OF URANIUM MONOCARBIDE BETWEEN 2250 AND 2500°K BY THE KNUDSEN EFFUSION METHOD [MESURE DE LA PRESSION DE DISSOCIATION DU MONOCARBURE D'URANIUM ENTRE 2250 ET 2500°K PAR LA METHODE D'EFFUSION DE KNUDSEN]

Francois Anselin and Jean Poitreau Jan. 1966 28 p refs In FRENCH

(CEA-R-2961)

Decomposition pressures of monocarbide samples and uranium carbon alloys of composition UC, were measured by the Knudsen effusion method. Samples were heated under vacuum in a tungsten effusion-cell by electronic bombardment and known fractions of the vapor were condensed on cooled targets. The determination of uranium content deposited on target was performed by chemical analysis, alpha counting, and recording and counting tracks of fission fragments of uranium in mica after irradiation of the targets in the reactor EL II at Saclay. The three techniques gave the same results. The decomposition pressure of UC with C/U=0.983 expressed in atmosphere of uranium is given by: $\log p\,(Ug)_{atm} = (2.570/T)\ 10^4 + 4.785$ in the temperature range from 2250° to 2500°K. The too low pressures measured under 2200°K and the instantaneous formation of a eutectic W–UC at about 2520°K limit the temperature range investigated. At constant temperature, a continuous pressure increase versus heating time was observed with $UC_{1.10}$ until a limit value was reached. This limit pressure was the same as measured with $UC_{1.00}$ under the same conditions at the same temperature. The pressure increase is related to a reaction between the tungsten in the cell and uranium carbide. The extrapolation at zero time of isotherms log p-versus time gave an estimation of dissociation pressure of $UC_{1.10}$ expressed in atmosphere of uranium: $\log p\,(Ug)_{atm} = -(2.60/T)\ 10^4 + 4.41$. Uranium decomposition pressures for both $UC_{1.00}$ and $UC_{1.10}$ were extremely low, and vaporization of carbide is congruent for a composition close to $UC_{1.10}$ in agreement with previous results. In contradiction with general agreement, tungsten is not compatible with uranium–carbon alloys at any composition.

Author (NSA)

N66-31128# Cornell Univ., Ithaca, N. Y. Dept. of Engineering Physics.

A GENERALIZED MODEL FOR THE CHEMISORPTION BEHAVIOR OF NITROGEN ON TUNGSTEN

William K. Warburton 1 Mar. 1966 88 p refs

(Contract Nonr-401(31))

(TR-9; AD-629480) CFSTI: HC $3.00/MF $0.75

A model to describe the chemisorption of beta-nitrogen on tungsten is discussed. It is based on the following assumptions: the binding is atomic, the energy is dissipated upon molecular desorption, the adsorption rate depends on heat of surface diffusion, the surface potential depends on the height of adatoms and an equilibrium concentration of molecular complexes is maintained on the surface during adsorption. The primary result of this model is the quantitative prediction of the existence of molecular complexes formed at high temperatures as a result of collisions between the nitrogen adatoms. This explanation is shown to be consistent with much of the published adsorption data of the nitrogen adatom adsorption's effects on the various tungsten planes' surface potentials and their temperature variations.

Author (TAB)

N66-31148# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF OBTAINING N-FLUOROVINYL COMPOUNDS
A. Ya. Yakubovich and A. P. Sergeyev 21 Sep. 1965 8 p Transl. into ENGLISH from Soviet Patent No. 166660 (Appl. No. 848911/23-4), 24 Jul. 1963 1 p
(FTD-TT-65-523/1+4; TT-65-64175; AD-622450) CFSTI: HC $1.00/MF $0.50

The object of the invention is a method for obtaining n-fluorovinyl compounds, which has the distinguishing feature that fluorinated olefins are subjected to interaction with N-metallic products of the general formula RR'N Me.
Author (TAB)

N66-31151# Cornell Univ., Ithaca, N. Y. Dept. of Engineering Physics.
DIFFUSION OF OXYGEN IN MAGNESIUM OXIDE
Lee H. Royner 1 Mar. 1966 158 p refs
(Contract Nonr-401(31))
(TR-10; AD-629491) CFSTI: HC $5.00/MF $1.00

Diffusion of oxygen in magnesium oxide is measured in the temperature range 750°–1150°C at 1 torr oxygen pressure. The measurements utilized an oxygen-18 isotopic exchange technique to measure diffusion coefficients as small as 10^{-20} cm^2/sec. Interference from diffusion down enhanced diffusivity channels is observed. Both intrinsic and extrinsic lattice diffusion is observed. In the intrinsic region the activation energy, Q, is 82.1±3 kcal/mole and $D \propto P_{O_2}^{0.22 \pm 0.1}$ cm^2/sec. For extrinsic diffusion Q=30.2±3 kcal/mole. This same activation energy is found in a crystal doped with chromium: Q=34.0±4 kcal/mole. Also, $D \propto P_{O_2}^{0.48 \pm 0.05}$ These data are compatible with an interstitial oxygen mechanism for both crystals. In a lithium-doped crystal, Q=42.6±4 kcal/mole and $D \propto P_{O_2}^{-0.7 \pm}$ 0.25 cm^2/sec. This is consistent with an oxygen vacancy mechanism. Under conditions appropriate for intrinsic diffusion, magnesium oxide is shown to be an oxygen excess structure. Charge compensation is by formation of trapped-hole defects. In lithium-doped material, trapped-electron defects are present. These defect species are important to the electrical conductivity properties of magnesium oxide.
Author (TAB)

N66-31178# Naval Research Lab., Washington, D. C.
THE ADSORPTION OF n-OCTADECYLAMINE, n-OCTADECANOIC ACID, AND n-OCTADECYL ALCOHOL FROM NON-AQUEOUS SOLUTION ONTO HYDRATED AND DEHYDRATED METAL OXIDE SURFACES Interim Report
W. D. Bascom 5 Oct. 1965 16 p refs
(NRL-6315; AD-624025) CFSTI: HC $1.00/MF $0.50

A study has been made of the adsorption of the normal C18 amine, acid, and alcohol from hydrocarbon solution onto freshly polished stainless steel, iron, nickel, chromium, and platinum surfaces as a function of substrate pretreatment. The pretreatment consisted of maintaining the polished surface for 3 hours in a helium or air environment at selected temperatures ranging from ambient to 320°C. Isolation of the monolayer-covered surface was accomplished by the method of retraction, and the degree of coverage was determined by measuring the contact angle. Treatment of the metal surface at temperatures from 25° to 200°C resulted in a more-or-less continuous decline in ability to adsorb a close-packed monolayer of the amine. Above 200°C, however, amine adsorption increased with increasing pretreatment temperature except on platinum. The regain in amine adsorption is believed to be connected with oxide film growth. In anhydrous solution neither the alcohol nor the acid formed a close-packed monolayer. On the other hand, it was possible to obtain a monolayer and even crystallites of octadecanoic acid when the substrate was heavily hydrated and the adsorbate solution was saturated with water.
Author (TAB)

N66-31201# Portugal. Nuclear Energy Commission, Sacavem. Lab. for Nuclear Physics and Engineering.
REDUCTION OF CERIC SULFATE IN THE PRESENCE OF THALLOUS IONS. INTRATRAJECTORY DISTRIBUTION OF THE PRIMARY PRODUCTS OF RADIOLYSIS [REDUCAO DO SULFATO CERICO EM PRESENCA DE IOES TALOSOS. REPARTICAO INTRATRAJECTORIA DOS PRODUTOS PRIMARIOS DE RADIOLISE]
M. Helena Mariano and Horacio M. Novais 1966 28 p refs In PORTUGEUSE
(LFEN.49 (ALPHA)) CFSTI: HC $2.00/MF $0.50

The curve which shows the variation in yield from the reduction of ceric sulfate by 5.3 MeV alpha particles as a function of the concentration in thallous ions gives a maximum value of $G(Ce^{3+})_{Tl^+}=3.40$, for $[Tl^+]=2.10^{-4}$M. The difference between the maximum and the theoretic value corresponding to the complete capture of the OH radicals by the thallous ions is attributed to the inhibition of inverse reactions of the radiolysis products in the second zone of heterogeneity of the alpha particle paths, and also to a fraction of Tl^{2+} produced inside the trajectory paths according to the expression $OH+Tl^+ \rightarrow Tl^{2+}+OH^-$, with hydrogen peroxide water before diffusion. It was established that the experimental values conform to the expression: $G(Ce^{3+})_{Tl^+}=2.G(H_2O_2)_{Tl^+}+2.G(Tl^{3+})$, where $G(H_2O_2)_{Tl^+}$ is yielded from the formation of hydrogen peroxide water in sulfuric solutions of Tl_2SO_4 without additional solutes, and $G(Tl^{3+})$ is yielded from the oxidation of the thallous ions in the Ce^{4+}–Tl^+ system.
Transl. by R.Ll.

N66-31212*# Shell Development Co., Emeryville, Calif.
DEVELOPMENT OF ANALYTICAL TECHNIQUES FOR HYDROCARBONS IN MINERAL AGGREGATES
D. P. Stevenson and A. G. Polgar Washington, NASA, Jul. 1966 55 p refs
(Contract NASw-438)
(NASA-CR-519) CFSTI: HC $3.00/MF $0.50 CSCL 08D

The results of the assay of the organic chemical constituents, primarily the hydrocarbons, of a variety of terrestrial sediments varying in age from recent ocean bottom sediments to pre-Cambrian slate and samples of five meteorites are discussed. Of the group of terrestrial samples examined, ocean bottom cores, shales, slates and limestones, only the last named were found to contain too little hydrocarbon to be detectable. The quantities of organic substances recovered ranged rom 10–30 ppm from the very old slates, to 300–900 ppm for the shales and ocean bottom sediments. The lower limits to the organic content of the specimens of the Murray and Hamlet meteorites were found to be 50 and 300 ppm, respectively. The kinds of hydrocarbon found in the meteorite extracts are very similar in both type and molecular weight distribution to those found in the extracts of the shales and slates. Further the kinds of hydrocarbons and the nature of the molecular weight distribution are such that biochemical processes very likely were required at some stage of their genesis.
Author

N66-31235# International Union of Pure and Applied Chemistry, Basle (Switzerland). Commission on High Temperatures and Refractories.

HIGH TEMPERATURE CHEMISTRY AND PHYSICS OF GASES AND PLASMAS Bibliography

L. Brewer, comp. (California Univ.) 31 Mar. 1966 38 p refs *Its* Bibliog. No. 18

Available from Natl. Bur. of Std., Washington, D. C.

An annotated bibliography is presented, broken down as follows: (1) spectroscopy for high temperature chemistry; and (2) chemical reactions between gases and condensed phases. D.T.

N66-31241# Technische Hogeschool, Eindhoven (Netherlands).

OVERDETERMINED LINEAR SYSTEMS IN MULTICOMPONENT SPECTROPHOTOMETRY

Israel Samuel Herschberg (Ph.D. Thesis) [1966] 173 p refs CFSTI: HC $5.00/MF $1.00

The possibility of increased precision of spectrophotometry, especially as applied to multicomponent analyses in the region accessible to quartz prism instruments, was investigated. Details are given on the experimental procedure and the mathematical model. The assumed linear relation between absorbance and concentration is analyzed, using a model consisting of an idealized monochromator applied to an idealized absorber. Nonlinearity is analyzed in terms of mixtures, and reasons for the nonlinearity are identified. Refinements are made to maintain linearity of the model. Some practical applications are described. The results were considered to be consonant with those of gas–liquid chromatography, and estimated to be of better precision for major constituents. N.E.N.

N66-31270# Harvard Univ., Cambridge. Mallinckrodt Chemical Labs.

A GENERAL PROGRAM FOR THE CALCULATION OF INTERNAL ROTATION SPLITTINGS IN MICROWAVE SPECTROSCOPY

Robert C. Woods 15 Apr. 1966 30 p refs

(Contract Nonr-1866(14))

(AD-631858) CFSTI: HC $2.00/MF $0.50

A theoretical basis is presented for a computer program which has been written to calculate the internal rotation splittings in the microwave spectra of molecules possessing a hindered internal symmetric top. This is an extension of the internal axis method and is applicable to a very general case, which includes any high barrier problem which is not a near spherical top. Any asymmetry, any geometry, and any size top can be handled by the program as it stands. The method involves the division of the Hamiltonian into a rotational part and a part involving internal rotation, the latter including the coupling between internal and overall rotation. The matrix elements of these parts are set up separately, each in the most convenient basis, then transformed to a common basis (symmetric rotor in principal axes), then to the Wang basis, and finally to the basis which diagonalizes the (large) rigid rotor part. The small off-diagonal elements which are left are treated by perturbation theory. This procedure has been incorporated in an efficient Fortran program which uses fully the various symmetry properties. Author (TAB)

N66-31299# Walter Reed Army Inst. of Research, Washington, D. C.

INTERFACIAL POLYMERIZATION OF N-ALKYL ALPHA CYANOACRYLATE HOMOLOGS

Fred Leonard, John A. Collins, and Harold J. Porter Apr. 1966 15 p refs

(TR-6605; AD-633169) CFSTI: HC $1.00/MF $0.50

The normal alkyl-2-cyanoacrylates from methyl through n-octyl exhibit a reverse order of polymerization rate on biological substrates than on water. On water, the lower homologs spread and polymerize rapidly, whereas the higher homologs spread but polymerize slowly. On biological substrates, the lower homologs do not spread or spread slightly, and the higher homologs exhibit large spreadabilities and very rapid polymerization rates. Determination of the spreading coefficients for these systems using the monomers or model compounds confirm the observed spreadabilities. It is proposed that the increased rate of polymerization of the higher homologs on biological substrates may be due to increased catalyst concentrations on these surfaces or to the solubilization of the higher homologs at the interface, making the catalyst sites more available to the monomer. The suggestion is made that if the liquid monomers spread and orient on the substrate and subsequently polymerize, the polymers will maintain the orientation. Author (TAB)

N66-31311# General Electric Co., Philadelphia, Pa. Missile and Space Div.

REACTION RATE CONSTANTS FROM CROSS SECTIONS

M. H. Bortner Feb. 1966 33 p refs

(Contract DA-49-146-XZ-497)

(R66SD14; AD-632685) CFSTI: HC $2.00/MF $0.50

The use of reaction rate constants to calculate changes in chemical composition usually is involved in systems having a Boltzmann kinetic energy distribution. Since many data for such reactions are obtained on monoenergetic systems, it is necessary to convert such data to the more useable form. Equations for such conversions are developed in this report. General expressions requiring graphical integrations to obtain rate constants are first obtained. Some specific relations between cross section and energy are used and integrated expressions are then obtained which, when applicable, give analytical expressions for rate constants. Any of the expressions are applicable only to the exact states for which the data were obtained. Author (TAB)

N66-31334# Virginia Univ., Charlottesville. Dept. of Chemistry.

TRICARBAHEXABORANE(7)

Christopher L. Bramlett and Russell N. Grimes 12 May 1966 8 p refs Submitted for Publication

(Contract Nonr-474(13))

(TR-2; AD-632866) CFSTI: HC $1.00/MF $0.50

Three major volatile products from the room temperature vapor-phase reaction of tetraborane(10) and acetylene were isolated and structurally characterized. These compounds were identified as C-methyl derivatives of tricarbahexaborane(7), which is the first three-carbon carborane to be reported. A fourth product is believed to be the parent compound, $C_3B_3H_7$, for which the structure 2,3,4-tricarbahexaborane(7) is proposed. Author (TAB)

N66-31371*# Massachusetts Inst. of Tech., Cambridge. Physics Dept.

VIBRATIONAL RELATION MEASUREMENTS IN CO_2 USING AN INDUCED FLUORESCENCE TECHNIQUE

L. O. Hocker, M. A. Kovacs, C. K. Rhodes, G. W. Flynn, and A. Javan [1966] 16 p refs
(Grant NsG-330)
(NASA-CR-76392) CFSTI: HC $1.00/MF $0.50 CSCL 07D

Preliminary experimental studies are reported for a number of relaxation processes involving excited vibrational levels of the CO_2 molecule. Infrared fluorescence was induced by the application of intense pulses of Q-switch 10.6 μ laser radiation and used to obtain an accurate measure of the rate of volume quenching of the first excited asymmetrical stretching mode, (00°1), of the CO_2 molecule. The relaxation and collisional coupling between various levels in the presence of a dc discharge in the sample tube is considered and its importance stressed. Consequences of these collisional couplings were that while the unsaturated gain of the 10.6 μ transition is determined only by the populations of the levels, the laser output power is determined by the populations of at least three additional (00°v) values; the steady state distribution of population among the (00°v) levels are noninverted; and in a Q-switch system where the 10.6 μ laser transition alone is allowed to oscillate, the population of the higher levels is no longer coupled to the laser field. S.P.

N66-31378*# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
X-RAY DIFFRACTION ANALYSIS OF COHENITE FROM IRON METEORITES
Michael E. Lipschutz [1966] 32 p refs
(Grant NGR-15-005-021)
(NASA-CR-76400) CFSTI: HC $2.00/MF $0.50 CSCL 07B

Results of an X-ray diffraction investigation of cohenite from 50 Canyon Diablo meteorites and 8 Odessa shock standards are reported. The crystal character of cohenite appears rather sensitive to shock pressure over the range 0 to >1000kb. The alterations observed apparently represent successive stages in the solid stage recrystallization of cohenite. This recrystallization probably occurs during the high-pressure portion of the shock wave since, because of cohenite's thermodynamic instability, the rate of its graphitization during low-pressure annealing appears to be much more rapid than its rate of recrystallization. It was possible to establish a pressure scale based on features observed in diffraction photographs of cohenite grains from shock standards. This pressure scale has verified the metallographic shock criteria proposed previously. The pressure gradient deduced by microscopy in a particular specimen has been verified and was found to be 20kb/cm. Estimates from metallographic criteria of the degree of shock suffered by Canyon Diablo meteorites is essentially paralleled by shock estimates based on cohenite alteration. The sensitivity of the X-ray technique also serves to identify shocked meteorites which have not been at a pressure high enough to induce metallographic changes. Author

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N66-30032# Defense Research Telecommunications Establishment, Ottawa (Ontario). Electronics Lab.
SIGNAL PROCESSING FOR THE ALOUETTE SATELLITES
G. T. Lake May 1966 18 p
(DRTE-1161) CFSTI: HC $1.00/MF $0.50

Signals from the Alouette I and Alouette II satellites are received at some 14 ground stations. Each station processes the signals and records the results on magnetic tape. The magnetic tapes are replayed through data processing equipment to produce ionograms on film, strip chart recordings, and magnetic tape copies. This report describes the equipment used to do this. Author

N66-30161# Naval Ordnance Lab., Corona, Calif.
SYNTHESIS STUDY OF A CONTINUOUS-SOURCE WAVEGUIDE ANTENNA
A. P. Boblett *In its* Foundational Res. Proj. 1 Mar. 1966 p 21-38 (See N66-30157 17-23) CFSTI: HC $4.60/MF $0.50

A study was made of the continuous-source waveguide antenna to find the current distribution that generates far-field patterns in which the maximum voltage of the main beam is at a specified angle from the forward direction and in which the maximum voltage of each side lobe is a specified fraction of the maximum voltage of the main beam. Although the resulting current distributions were found to be of little practical value for a continuous source, the basic synthesis method derived could be used as a starting point for further developments. Author

N66-30163*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
MILLIMETER COMMUNICATION PROPAGATION PROGRAM, VOLUME I Final Report, 1 Nov. 1964-1 Nov. 1965
[1965] 177 p refs
(Contract NAS5-9523)
(NASA-CR-76093; FR-65-334-1; E-733-65-1) CFSTI: HC $5.00/MF $1.00 CSCL 20N

The complete experiment design study to determine the effects of the propagating medium on millimeter wave space-earth communications is summarized. Channel characteristics, atmospheric absorption and refraction, antenna temperature, flat fading, selective frequency fading, coherence bandwidth, special decorrelation, and plasma effects are discussed. The basic measurements which should be made are defined, and the test waveforms or channel probes used to obtain these measurements are described. The basic correlative measurements using meteorological radiometric and radar instrumentation are identified. Orbital constraints for the synchronous, medium, and low altitude satellites are given. The ground and spacecraft hardware, and weight, volume and power estimates are outlined. The evaluation of the ground facilities, and the data collecting and processing programs are summarized. The study was based on use with the Applications Technology Satellite and Manned Orbiting Laboratory, and centers around frequencies of 15, 35, and 94 Gc. Specific recommendations are presented. N.E.N.

N66-30164*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
MILLIMETER COMMUNICATION PROPAGATION PROGRAM, VOLUME II Final Report, 1 Nov. 1964-1 Nov. 1965

[1965] 230 p refs
(Contract NAS5-9523)
(NASA-CR-76095; FR-65-334-2; E-733-65-2) CFSTI: HC $6.00/MF $1.25 CSCL 20N

The processing and evaluating of the raw data, collected during the millimeter wave propagation experiments for space–earth communications, are described. The effects of atmospheric refraction on pointing large millimeter wave ground antennas at spacecraft are discussed, and the refraction errors encountered when looking down at a given point on the earth from a spacecraft are given. The usefulness of radiometric sky temperature data and weather radar rainfall data are pointed out. The importance of aircraft flight tests during early phases of the program, and the use of receivers instead of transmitters in an Applications Technology Satellite are stressed. The concepts of processing and evaluating millimeter propagation data taken from space–earth channels are presented in detail. Definitions of the channel parameters and the mathematics for computing these parameters are included. Characteristics are given for the general, low altitude, synchoronous, and 6000 nautical mile altitude orbits and for the millimeter wave antennas. N.E.N.

N66-30188*# Hughes Aircraft Co., Fullerton, Calif. Ground Systems Group.
MODIFICATION OF DSIF SCM FEEDS Final Report, 11 Jun. 1963–7 Jan. 1964
11 Jan. 1964 58 p Prepared for JPL
(Contracts NAS7-100; JPL-950639)
(NASA-CR-76123) CFSTI: HC $3.00/MF $0.50 CSCL 09F

This program was conducted to study the feasibility and develop a technique for using several modes in a rectangular horn to accomplish primary pattern shaping and monopulse capability for use as a high performance Cassegrain feed. A technique was formulated, a design procedure established, and a unit fabricated and tested. The feed provides monopulse tracking in two planes, dual circular polarization capability, and less than 1°K noise contribution from interchannel coupling in the monopulse bridge. The theory, design, and experimental results of this unit are discussed. Author

N66-30256*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE DESIGN OF NUMERICAL FILTERS FOR GEOMAGNETIC DATA ANALYSIS
Kenneth W. Behannon and Norman F. Ness Washington, NASA, Jul. 1966 38 p refs
(NASA-TN-D-3341) CFSTI: HC $2.00/MF $0.50 CSCL 09D

A numerical filtering technique useful in removing the diurnal component from surface data of magnetic field measurements is described. Derivations of formulas used to compute filter weights and several examples of the current use of such filters are presented and outlined. Author

N66-30263# Istituto Universitario Navale, Naples (Italy).
RADIO SURFACE WAVES Annual Summary Report
E. Corti, G. Franceschetti, and G. Latmiral 31 Jan. 1966 64 p refs
(Contract AF 61(052)-851)
(AFCRL-66-214; AD-632275) CFSTI: HC $3.00/MF $0.75

The link between submerged transmitting and surface-receiving antennas was computed by using the Lorentz reciprocity theorem. The resistance radiation of a submerged linear antenna was computed. Author (TAB)

N66-30289*# Westinghouse Electric Corp., Baltimore, Md. Aerospace Div.
INFRARED SENSOR FOR APOLLO REENTRY Final Report, 1 Jul.–30 Dec. 1964
[1965] 113 p refs
(Contract NAS5-9703)
(NASA-CR-62570) CFSTI: HC $4.00/MF $0.75 CSCL 17E

When the Apollo reentry vehicle enters the earth's atmosphere with lunar return velocity, the air surrounding the vehicle should ionize to such an extent that radio frequency communications with the ground tracking stations will be seriously impaired during the critical initial phase of deceleration to suborbital velocity. Infrared tracking could augument the rf tracking during the blackout period by angle tracking the reentry vehicle induced radiation thereby providing angle position data for immediate reacquisition by the rf tracking systems following blackout. A feasibility study indicated that a combination of airborne high-resolution passive infrared detection systems would be required to detect the reentry vehicle induced radiation. Objectives were to perform the design studies and develop an engineering model to demonstrate the capabilities of this detection approach. Author

N66-30306*# Raytheon Co., Sudbury, Mass. Space and Information Systems Div.
MILLIMETER COMMUNICATION PROPAGATION PROGRAM, VOLUME III Final Report, 1 Nov. 1964–1 Nov. 1965
[1965] 104 p refs
(Contract NAS5-9523)
(NASA-CR-76131; FR-65-334-3; E-733-65-3) CFSTI: HC $4.00/MF $0.75 CSCL 17B

An annotated bibliography is given of documents used in and related to the millimeter communication propagation program, for designing experiments to determine the effects of propagating medium on millimeter wave (10 to 100 gigacycles) space–earth communications. The documents are broken down into 10 categories: meteorology, atmospheric propagation, plasma effects, channel characterization, communication system performance, communication system applications, antennas and components, circuits, experimental ground facilities, and other bibliographies. A technical background is included to show how the documents described tie in with the experiment design study, and the contents of the contract reports are given in outline form. L.E.W.

N66-30317*# Research Triangle Inst., Durham, N. C.
AN ANALYTICAL INVESTIGATION OF RADIO FREQUENCY INTERFERENCE AND ACQUISITION PROBABILITY FOR A COMBINATION RADAR AND TELEMETRY SYSTEM Final Report, May 14, 1965–May 31, 1966
31 May 1966 211 p refs
(Contract NAS1-5065)
(NASA-CR-66097; TRR-29) CFSTI: HC $6.00/MF $1.25 CSCL 09F

Details are presented for an analysis of the detection and acquisition capabilities of a combined radar and telemetry tracking system, as well as the interference problems associated with its use. The system uses a 30-ft dia cassegrain antenna with a combined L-band X-band monopulse feed system with dual polarization capability. Because of the narrow antenna bandwidth at X-band and the lack of a strong signal return at L-band, target acquisition presents difficulties. Interference problems due to using the same antenna for radar transmission and telemetry reception are also considered, as are personnel hazards which may be

associated with the radar and modifications of the CW X-band receiver to permit operation on pulsed telemetry. Acquisition probability and radio frequency interference studies are detailed. Radar cross section measurements for the Scout launch vehicle are included, a volumetric uncertainty model is given, circuit diagrams and alignment procedure for receiver modifications are discussed, and single look probability of detection for a fluctuating target is described. Computer programs ALPHA and TRAJAN are described. M.W.R.

N66-30329*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPUTED RADIATION PATTERNS FOR A DUAL-PLANE AMPLITUDE-SENSING MONOPULSE ANTENNA USING AN ELECTRONIC BORESIGHT SCANNING TECHNIQUE

Armondo D. Elia and Richard F. Schmidt Feb. 1966 33 p refs

(NASA-TM-X-55506; X-525-66-84) CFSTI: HC $2.00/MF $0.50 CSCL 09F

This report presents the scanned and unscanned radiation-pattern derived characteristics of an amplitude sensing monopulse antenna equipped with an electronic boresight scanning circuit. A signal simulator, used for generating the monopulse antenna signals, is also presented. Author

N66-30335*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE OUTPUT AUTO CORRELATION FUNCTION AND POWER SPECTRAL DENSITY OF A DIODE FREQUENCY CONVERTER

Louis J. Ippolito Mar. 1966 99 p refs

(NASA-TM-X-55512; X-733-66-113) CFSTI: HC $3.00/MF $0.75 CSCL 09F

This paper presents the output power spectral density of the diode frequency converter when subjected to deterministic, statistical, and mixed inputs by application of the Wiener–Khintchine Theorem to the autocorrelation function of the diode output current. The converter output autocorrelation function for the general signal plus noise case and for particular signal inputs is presented in terms of the diode conductance constants and the statistical moments of the input signal. All of the autocorrelation and power spectra functions developed are expressed in series form to permit a useful analysis of the contributions of the diode conductance constants to each term. From these spectral displays, the optimum diode characteristics for efficient frequency conversion can be generated and the filtering and power requirements of the converter determined. Author

N66-30348*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

SUGGESTED FREQUENCY RANGES FOR SPACE MISSIONS

Paul E. Schmid 1 Mar. 1966 33 p refs

(NASA-TM-X-55525; X-507-66-169) CFSTI: HC $2.00/MF $0.50 CSCL 17B

The purpose of this report is to review briefly the limiting parameters affecting frequency selection for space missions in the 0.1 MHz to 100 GHz radio-frequency range. Frequency selection for capsule recovery is also considered. Author

N66-30350*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

OPTICAL AND MICROWAVE COMMUNICATIONS—A COMPARISON

F. Kalil Mar. 1966 73 p refs

(NASA-TM-X-55527; X-507-66-173) CFSTI: HC $3.00/MF $0.75 CSCL 17B

Some preliminary comparisons were made of microwave, millimeter, and optical communication systems for space communication from a spacecraft at Mars distances. An attempt was made to be realistic with regard to technology. Some discussion of thermal, quantum, and sky noise is included, as well as some discussion and analyses of microwave, millimeter wave, and optical technology; acquisition and tracking; and some mission analysis. Based on the considerations herein, it appears likely that in the radio spectrum the S-Band is the better place to operate. However, it appears likely that optical communication systems have the greater potential for higher data rates—up to about 10^8 bps at Mars distances. Author

N66-30356*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

APOLLO PLASMA SHEATH IN-FLIGHT DIAGNOSTICS

B. Rosenbaum 5 Apr. 1966 42 p refs

(NASA-TM-X-55533; X-507-66-203) CFSTI: HC $2.00/MF $0.50 CSCL 17B

The characteristics of several electron density probes are discussed for their potential application to Apollo in-flight plasma sheath diagnostics. A description is given of the microwave resonant type probes, for measurement of electron density in shock tubes and shock tunnels. The internal cavity probes operate in supersonic flow and the dielectric waveguide type probes operate along the stagnation streamline of separated flow. These probes are considered to be adaptable for in-flight application. A wedge-shaped Langmuir type probe, developed for diagnostics of supersonic plasma flow, is briefly described. Author

N66-30362*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A FOCUS SPOILING RETRODIRECTIVE MODULATOR

Michael W. Fitzmaurice May 1966 92 p refs

(NASA-TM-X-55539; X-524-66-248) CFSTI: HC $3.00/MF $0.75 CSCL 09F

This paper analyzes a semi-passive optical modulator which can be incorporated into a satellite to ground laser communication link or a ground to ground laser link. The system has limited bandwidth capabilities but is useful as a first step in evaluating the utility of lasers in communication through the earth's atmosphere. Modulation is imposed on a reflected beam by varying the optical properties of the retrodirector by a piezoelectric induced displacement. An analysis of the piezoelectric transducer is carried out and equations developed which are used in a typical design procedure. Experimentally, the validity of a geometrical optics approach to the modulation capabilities of the retrodirector is verified. In addition, the need for high speed displacement measurement techniques is noted and two solutions are presented. The first, employing an accelerometer, offers extreme accuracy but relatively narrow frequency response. The second approach utilizes the fringe pattern in a Michelson interferometer and has reduced accuracy but virtually unlimited frequency response. Author

N66-30383*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A CHAIN MATRIX ANALYSIS OF AN ELECTRONIC BORESIGHT SCANNING TECHNIQUE FOR A DUAL-PLANE AMPLITUDE-SENSING MONOPULSE ANTENNA

Armondo D. Elia and Richard F. Schmidt 19 July 1965 59 p refs

(NASA-TM-X-55540; X-525-65-300) CFSTI: HC $3.00/MF $0.50 CSCL 09F

This report is an analysis of a dual-plane amplitude-sensing monopulse system which relates to the essentially inertialess displacement of the sum and difference patterns in space with respect to the antenna coordinates. The development is predicated on the concept of scattering and transfer matrices. It is shown that the dual-plane electronic boresight scanning (EBS) problem considered here can be regarded as lying in an eight-dimensional vector space in which the terminal quantities are analogous to the basis vectors which span the space. The transmission and reception properties of the circuit are separated by a direct-sum decomposition and only the reception case is considered in detail for the angular resolution problem treated herein. Author

N66-30378*#

SPACE COMMUNICATION—ITS IMPLICATIONS FOR PEACE

Stuart Symington *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 97–98 (See N66-30366 17-30) GPO: HC $1.50; MF $1.25

A general review is presented of the development of world-wide communications and the necessity of encouraging private industrial and international cooperation in the development of a satellite communications system for peactime applications. The importance of better international communications in encouraging freedom throughout the world is stressed. M.W.R.

N66-30383*# Communication Satellite Corp., Washington, D. C.

THE COMING ERA OF SATELLITE COMMUNICATIONS

Joseph V. Charyk *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 137–144 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

Future possibilities of satellite communications are discussed in light of recent developments and the increasingly rapid need for international communications. It is pointed out that it is now possible to think of massive computer operations on a global scale, whereby satellites can be used for data preparation, correlation, computation, and exchange. Mention is made of television, an international art auction, and communications between a jet airliner near Hong Kong and a ground station in California, all made possible by the communications satellite now in orbit. Design of the three basic types of satellite systems is discussed: (1) a medium altitude, random orbit system; (2) a medium altitude phased orbit system; and (3) a synchronous system. The medium altitude, random orbit system is not recommended for global deployment because of difficulties in continuity and the number of satellites required; a modification for initial positioning of satellites has been proposed. It appears that a design can be evolved for use in synchronous orbit or in a phased array at any altitude between 6,000 feet and synchronous altitude. M.W.R.

N66-30384*# American Telephone and Telegraph Co., New York.

COMMUNICATIONS PROGRESS AND PROBLEMS

Richard R. Hough *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 145–148 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

A brief overall view on the growth of communications media and their connected technological innovations is presented, with emphasis on communications satellites. New developments in microwave transmission, transistors, solar batteries, masers, negative feedback, switching circuits, and microminiaturization techniques play an important role in the economics of continuous communications services and the exploration of space. G.G.

N66-30385*# Radio Corp. of America, New York.

FUTURE IMPLICATIONS OF COMMUNICATIONS TECHNOLOGY

Elmer W. Engstrom *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 149–154 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The impact of space satellites on worldwide communications systems and their role as relays across transoceanic or transcontinental distances is projected. Linking of computers with wideband, high capacity, two way communications facilities will it make possible to pipe communications services such as television, FM radio programs, and even high speed facsimile newspapers directly into homes. This system could carry telephone conversations in sight and sound, could be used in sampling, voting, and opinion taking surveys, as well as to provide direct access from the home to electronic libraries, stores, theaters, public facilities, etc. A system of broadcasting directly from satellites to television receivers can be a powerful agent for teaching over large areas of the globe. G.G.

N66-30392*# Auburn Research Foundation, Inc., Ala.

AN ANALYTICAL EVALUATION OF THE MILLS CROSS AND THE TWO-DIMENSIONAL MATRIX ANTENNA ARRAY Technical Report No. 4

H. M. Summer 15 May 1964 67 p refs

(Contract NAS8-5231)

(NASA-CR-76158) CFSTI: HC $3.00/MF $0.75 CSCL 09F

The field intensity patterns of both arrays when crossed-slot antennas are used as elements were determined, and a comparison was made of the beamwidths and the directivities. The arrays are described, and the analytical development is presented for them and the crossed slot antenna. The antenna array patterns are given for several sizes of arrays. The directivity was found to increase rapidly with the size of the array. The directivity was also considered to be a valid representation of the matrix array and is proportional to its gain. A more accurate expression was developed for the Mills cross array directivity. The fewer number of elements to produce a certain beamwidth gives the Mills cross array an advantage, but it can only be used in specialized applications. The possibility was shown for scanning the beam of the array throughout the hemisphere. The beam shape was determined to change slightly for moderate scan angles and more drastically for greater angles. An optimum spacing was used to eliminate the appearance of grating lobes, but no reduction in sidelobe level was obtained. N.E.N.

N66-30393*# Auburn Research Foundation, Inc., Ala.

AROD REAL TIME DATA EXTRAPOLATION Technical Report No. 5

H. M. Summer 14 Jul. 1964 107 p refs
(Contract NAS8-5231)
(NASA-CR-76157) CFSTI: HC $4.00/MF $0.75 CSCL 09F

A technique for minimizing reacquisition time following a signal interruption and for reducing the data lost due to the interruption in the space vehicle tracking system is reported. Finite difference operators and the development of interpolation formulas are reviewed. A computer program, written in Fortran II for the IBM 1620, was designed to use eleven data points from any function, take up to ten differences, and make up to 200 extrapolations. A second program, designed to use data from arc-tangent functions only, was written to perform extrapolations and to compute the percent error of each extrapolated point. These programs and the graphed data are presented. It was concluded that extrapolations of the arc-tangent data can be made with a high degree of accuracy along the slowly changing portion of the curve. Along the rapidly changing portion near the origin, the accuracy is poor after three or four extrapolations. It was further concluded that the probability of loss of phase-lock during the period of signal loss, even near the origin, should be reduced. N.E.N.

N66-30401*# National Engineering Science Co., Pasadena, Calif.
RESEARCH STUDY OF SOME RAM ANTENNAS Final Report, 18 Nov. 1964–18 Jun. 1965
C. M. Knop, H. Hodara, L. Butler, P. Gilon, A. W. Love et al Jun. 1965 441 p refs
(Contract NAS1-4623)
(NASA-CR-66103; SN-226) CFSTI: HC $7.41/MF $2.25 CSCL 09F

CONTENTS:

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3. DETERMINATION OF RADIATION PATTERNS FOR A CIRCULAR WAVEGUIDE SLOT ARRAY C. M. Knop 61 p refs (See N66-30404 17-09)

N66-30402*# National Engineering Science Co., Pasadena, Calif.
DETERMINATION OF THE INPUT IMPEDANCE AND THE RADIATION PATTERNS FOR A CYLINDRICAL GAP ANTENNA
H. Hodara *In its* Res. Study of Some RAM Antennas Jun. 1965 151 p (See N66-30401 17-07) CFSTI: HC $7.41/MF $2.25

A summary is presented of the results obtained from a program to investigate the performance characteristics of a single feed cylindrical gap antenna. The areas considered were: analysis and measurement of the antenna input impedance with no coating; analysis of the antenna input impedance with a radially varying plasma; and analysis and measurement of the radiation characteristics. A detailed technical discussion of these areas is provided and recommendations for further investigations are made. H.S.W.

N66-30403*# National Engineering Science Co., Pasadena, Calif.
DETERMINATION OF INPUT ADMITTANCE AND RADIATION PATTERNS FOR WAVEGUIDE EXCITED-AXIALLY SLOTTED CYLINDRICAL ANTENNAS
C. M. Knop *In its* Res. Study of Some RAM Antennas Jun. 1965 197 p refs (See N66-30401 17-07) CFSTI: HC $7.41/MF $2.25

Analytical expressions were derived for the input impedance of two types of feed arrangements: the butt-feed waveguide and a waveguide shunt slot feed. Discussions are provided of the first order solutions for admittance and radiation patterns for waveguides with and without coatings. An analysis of the conclusions from these investigations indicates that the radiation fields produced and the external admittance of a slot with a specified tangential electric field, can be determined by breaking up the nonhomogeneous coating into layers. Additionally it is stated that using the methods discussed for either a butt-feed waveguide or a shunt slot waveguide feed, the admittance as seen by the waveguide can be related to this external admittance, and can be determined from it. H.S.W.

N66-30499# European Atomic Energy Community, Brussels (Belgium).
METHOD FOR THE CHOICE OF CARRIER-FREQUENCIES IN THE DATRAC SYSTEM (DATRAC: DATA TRANSMISSION VIA CABLE) [METHODE FUER DIE AUSWAHL DER TRAGER-FREQUENZEN IM DATRAC SYSTEM (DATRAC: DATENUEBERTRAGUNG UEBER KABEL)]
W. Becker Jun. 1966 25 p refs In GERMAN; ENGLISH summary
(EUR-2969-d) CFSTI: HC $1.00/MF $0.50

Some basic technical view-points concerning a frequency multiplex system for data transmission over short distances are dealt with. In order to keep the lay-out of the system as simple as possible for the provided application, frequency mixers in the receiver have been avoided. Thus the channel selection filters are directly tuned to the corresponding channel center frequencies. Distinction is made between two kinds of parallel systems: (1) systems where the time response of the filters is the same on all channels, and (2) systems where the relative channel width is the same for all channels. A simple procedure to fix the channel center frequencies is described considering the transmission speed, the safety margin from the response time and the possible interference by harmonics or first order mixed frequencies, simultaneously trying to put the overall band of transmission in its frequency range as low as possible for reasons of attenuation and frequency stability. Examples are given for a simultaneous switch-through of all receiver channels in order to impede transients. Author

N66-30511# Stanford Research Inst., Menlo Park, Calif.
LITERATURE SURVEY PERTAINING TO ELECTRICALLY SMALL ANTENNAS, PROPAGATION THROUGH VEGETATION, AND RELATED TOPICS Special Technical Report No. 17
John Taylor, Kenneth A. Posey, and George H. Hagan Jan. 1966 287 p refs
(Contract DA-36-039-AMC-00040(E); ARPA Order 371)
(AD-629155) CFSTI: HC $6.00/MF $1.50

Bibliographical references, with abstracts wherever possible, are given for reports, papers, and books pertaining to the theory and practical use of electrically small antennas in a variety of environments and locations. References are grouped by content into categories: electrically small antennas; matching circuits and antenna impedances; ground constants; ground proximity loss; buried antennas; propagation over lossy ground; propagation through stratified media; propagation through vegetation; patterns and

directivity of antennas over lossy ground; books, bibliographies, and surveys; and general, including historical reviews. A list of authors and an index of cross references between categories are provided. The dates of the references extend from pre-world War II to early 1966, with the preponderant emphasis on the period 1960–1966. Author (TAB)

N66-30529*# Philco Corp., Blue Bell, Pa. Communications and Electronics Div.

RESEARCH AND DEVELOPMENT OF AN OPTIMIZED LABORATORY SPEECH-COMPRESSION SYSTEM FOR SPACECRAFT APPLICATION. TASK 7: MICROMINIATURIZATION STUDY

David M. Jurenko and James M. Loe 25 May 1966 35 p
(Contract NAS9-4523)
(NASA-CR-65424) CFSTI: HC $2.00/MF $0.50 CSCL 17B

Microminiaturization of an optimized laboratory speech-compression system for spacecraft application was considered. The microcircuit technology with respect to availability, reliability, size, weight, maintainability, power dissipation, and cost are discussed. The four major approaches to microminiaturization of electronic circuits, i.e., silicon solid-state, thin film, thick film, and metal oxide semiconductors, are discussed in relation to the speech-compression system. Block diagrams illustrate the synthesizer, analyzer, pitch extractor and generator, voicing detector, one channel of formant analyzer, and one channel of synthesizer and pitch generator. It was concluded that an effective microminiature package is feasible without major redesign of any block of the breadboard system, and that the only major microcircuit development needed would be for the thick-film bandpass filters. L.E.W.

N66-30534*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

TRACKING SYSTEMS, THEIR MATHEMATICAL MODELS AND THEIR ERRORS. PART II: LEAST SQUARE TREATMENT

W. D. Kahn and F. O. Vonbun Sep. 1965 67 p refs
(NASA-TM-X-55545; X-507-66-198) CFSTI: HC $3.00/MF $0.75 CSCL 17I

The purpose of this paper is to analyze in detail the errors in position and velocity of a spacecraft, utilizing weighted least squares. Included in this analysis are random and bias errors in the measurements and bias errors in the location of the tracking stations. Further, a discussion on the error ellipsoid is presented, as well as the transformation of the spacecraft position and velocity errors into impact parameters in position and time. A numerical example is given to illustrate how these equations can be used for practical analysis. Author

N66-30538*# Philco Corp., Blue Bell, Pa. Communications and Electronics Div.

RESEARCH AND DEVELOPMENT OF AN OPTIMIZED LABORATORY SPEECH COMPRESSION SYSTEM FOR SPACECRAFT APPLICATION. TASK 6: SPACE MISSION APPLICATIONS STUDY

Charles F. Teacher and David M. Jurenko 25 May 1966 30 p refs
(Contract NAS9-4523)
(NASA-CR-65423) CFSTI: HC $2.00/MF $0.50 CSCL 17B

The application of the narrow bandwidth speech communication processing system to future lunar and interplanetary missions is assessed. The sources of noise to which the system would be subjected when placed in operation aboard a space vehicle are discussed, and the characteristics and magnitude of such interference are delineated for solar and galactic noises, radio stars, and atmospheric, auroral, man-made, and terrestrial noises. The speech processing system, which can produce intelligible speech at a bandwidth requirement of only 160 Hz, is compared with a conventional 3000 Hz speech system to show the bandwidth compression advantages. Performance comparisons between processed and unprocessed speech for both analog and digital systems show that a 12.7 dB improvement can be obtained by using developed speech processing equipment. Results indicate that the processing can benefit telemetry and other communications as well as the voice transmission. It was also concluded that while the system has potential for lunar missions, it would be of most benefit to an interplanetary mission where large amounts of power would ordinarily be required. M.G.J.

N66-30543*# Philco Corp., Blue Bell, Pa. Communications and Electronics Div.

RESEARCH AND DEVELOPMENT OF AN OPTIMIZED LABORATORY SPEECH-COMPRESSION SYSTEM FOR SPACECRAFT APPLICATION Final Report, 25 May 1965-25 May 1966

David M. Jurenko, James M. Loe, and John P. Schultz 25 May 1966 125 p refs
(Contract NAS9-4523)
(NASA-CR-65425) CFSTI: HC $4.00/MF $1.00 CSCL 17I

Research and experimental techniques for developing an optimized laboratory speech-compression system for spacecraft application are described. The original design concept centered on the single-equivalent formant; however, since it was not successful in transmitting and synthesizing perceptually acceptable dipthongs, semivowels, and liquids, the concept was modified to a two-formant system. The final narrow-band speech-compression system operated at an information rate of 100 Hz. It is multiplexed by pulse amplitude modulation, filtered to fit in a 160-Hz transmission channel, demultiplexed using a digital approximation of the transversal filter equalizer, and synthesized by an active voltage tuned filter. Synchronization is achieved using threshold detection of the sync pulse whose integrity is maintained by immediately preceding it with a blank or zero information channel. It was found that the 160-Hz, two-formant speech communicator has shown phonetically balanced intelligibility test scores of 70% to 80% in a multiplexed connection. Specifications governing the noise-cancelling dynamic microphone, details on the voltage tunable filters used, breadboard operating instructions, and circuit diagrams for the analog portion of the system are given. L.E.W.

N66-30551# General Time Corp., Stamford, Conn. Acronetics Div.

A PRECISION TRACKING DRIVE SYSTEM Final Report, Jul. 1963–Jan. 1966

Chester A. Darling 5 Jan. 1966 107 p
(Contract AF 19(628)-3293)
(AFCRL-66-71; AD-631706) CFSTI: HC $10.60/MF $0.75

This report covers the modification of a Rawin Set AN/GMD-2 azimuth and elevation tracking system to provide

improved tracking characteristics and conversion to solid-state circuitry throughout the control system. The analyses leading to the design of satisfactory compensation circuitry are described, as are the special test units used in measuring functions and responses. Author (TAB)

N66-30558# Rock Island Arsenal Lab., Ill. Future Weapons Office.
KINEMATICS OF A TRACKING GIMBAL
Wright K. Gannett [1966] 17 p
(AD-632585) CFSTI: HC $1.00/MF $0.50

This paper presents formulas for angular displacements, velocities, accelerations, and torques required about the individual axes of a two-axis gimbal system in which a tracking device swivels universally in error-free tracking of any specified tactic of an unaccelerated target. These formulas apply, for example, to missile and satellite trackers, theodolites, optical sights of weapons, and—by extension—to the weapon itself, displaced through a lead angle. The target can move in any direction through space, air, water, or on the ground. The gimbal system is carried on an unaccelerated platform and the pintle may be oriented any fixed spatial direction. The effect of target tactics on the choice of gimbal orientation is discussed, particularly in its effects on smoothness and speed of tracking. Author (TAB)

N66-30560# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
EXPERIMENTAL ERROR AND SIGNAL DATA FROM HIGH BIT RATE TACTICAL TROPOSCATTER DIGITAL COMMUNICATION LINK Technical Report No. 174 (Final)
M. P. Ristenbatt and E. P. Gould Apr. 1966 118 p refs
(Contract DA-36-039-SC-89168)
(Rept.-4951-5-F; AD-632102) CFSTI: HC $4.00/MF $1.00

This report describes experimental error and signal-data from a 100 mile troposcatter digital communication link at a bit rate of 576 kc. A repetitive one-zero pattern with binary FM was used at 4.8 kMc. Data were taken in each of the four seasons, recording 10 to 15 six-minute tapes per season. The objective was a detailed computer analysis of error behavior, including analysis of instantaneous signal behavior so as to describe system conditions during errors. Five signals were sampled and multiplexed directly onto a digital tape: AGC, combiner, channel A, channel B, and local error count. From the equipment point of view, increases in tolerable fade length do not appear profitable until one exceeds 30 to 50 milliseconds. Further increases sharply reduce the probability of encountering such fades. Finally, the results verified that there is little signal variation from season to season except varying median level. In general, the data analyzed here permit determining the requirements for synchronization circuits of the fading link. In addition, the data here serve as an indicator of what can be expected with 100 mile troposcatter links at a bit rate of 576 kc. Author (TAB)

N66-30563# Ohio State Univ. Research Foundation, Columbus.
ANTENNA LOBE SUPPRESSION. VOLUME I: MODIFICATION OF HORN ANTENNAS FOR LOW SIDELOBE LEVELS Final Report
R. Lawrie, L. Peters, Jr., and C. Davis Griffiss AFB, RADC, Oct. 1965 31 p refs *Its* Rept.-1767-2
(Contract AF 30(602)-3269)
(RADC-TR-65-186, Vol. I; AD-623072) CFSTI: HC $3.00/MF $0.50

Four modified horn antennas with greatly reduced backlobes are described. The principal method of reducing backlobes consists of preventing the energy from illuminating the edges from which it is diffracted into the back regions. The mechanism for forcing energy away from these edges is the use of microwave absorber material, choke slots, and corrugated surfaces. An additional feature of these devices is an extremely smooth main beam with no discernible sidelobes. A diffraction screen has also been constructed that makes use of this principle. Such screens should find application in the reduction of ground clutter in radar systems. Author (TAB)

N66-30610*# Wolf Research and Development Corp., Bladensburg, Md. Applied Sciences Dept.
GEOS PRE-PROCESSING REPORT
S. J. Moss, R. L. Brooks, and E. Hyman Apr. 1966 119 p refs
(Contract NAS5-9756)
(NASA-CR-76228) CFSTI: HC $4.00/MF $0.75 CSCL 09F

Data acquisition and reduction procedures are reported for the instrumentation systems tracking the GEOS-A geodetic satellite. Details are presented for the various optical experiments employing the Minitrack Optical Tracking System (MOTS), various cameras, and tracking equipment. Electronic experiments are also reported, including range and range rate data, laser studies, and a Doppler investigation. Pre-processing for the GEOS-A observational data is described for the various instrumentation systems, the nature of the measurements are reported, the basic operation of each individual system and its hardware calibration are included, and sources and estimates of errors are considered. M.W.R.

N66-30621# Joint Publications Research Service, Washington, D. C.
MEASURING IRREGULAR REFRACTION OF RADIO WAVES IN THE IONOSPHERE BY SIGNALS FROM ARTIFICIAL EARTH SATELLITES
Yu. L. Kokurin and Yu. A. Kovura 8 Jul. 1966 15 p refs Transl. into ENGLISH from Radiotekhn. i Elektron. (Moscow), v. 11, no. 3, 1966 p 439–444
(JPRS-36368; TT-66-32800) CFSTI: $1.00

A marine radio interferometer was used to monitor signals from the Elektron II satellite in order to measure the irregular refraction of radio waves in the ionosphere. The measurement method, field at the reception point, and the case of reception of one signal component are considered. It is shown that when a marine interferometer is used to receive satellite signals, only the horizontally polarized components can be used; and there is no need to account for the amplitude-phase fluctuation of the field caused by sea waves at the reception point. M.W.R.

N66-30625# Federal Aviation Agency, Atlantic City, N. J. Test and Evaluation Div.
TEST OF A GENERAL AVIATION TRANSPONDER MODIFIED TO INCORPORATE A CRYSTAL VIDEO RECEIVER Final Report
Robert A. Waldmann Apr. 1966 36 p
(RD-66-27)

A transponder incorporating a crystal video receiver was tested to determine whether it is technically feasible to use this type of receiver in the design of future radar beacon transponders. Laboratory tests at both room temperature

and under environmental conditions were conducted of the unmodified transponder, and the same unit as modified by the contractor. The modified transponder met specifications or performed as well as the unmodified one during most tests; however, the unmodified transponder exhibited a low gain-bandwidth product. It was concluded that the use of a crystal video receiver in place of the superheterodyne receiver in radar beacon transponders is technically feasible; and, when designed as an integral part of a new transponder, may effect a reduction in the cost, weight, or power consumption of the transponder. Author

N66-30632# Technische Hochschule in Wien (Austria). Institut für Niederfrequenztechnik.
SPEECH QUALITY MEASUREMENTS Annual Summary Scientific Report
E. H. Rothauser and G. E. Urbanek 31 Dec. 1965 157 p refs
(Contract AF 61(052)-856)
(AFCR-L-66-170; AD-633309) CFSTI: HC $5.00/MF $1.00

This paper is concerned with studies being conducted on a modified isopreference method for rating speech communications systems in view of speech quality. The concept of speech quality is studied by subjective measurements in terms of intelligibility and 'preference'. Listening experiments using the forced pair comparison technique have been performed with trained and untrained groups of listeners. Various kinds of speech signals from different systems have been compared with three idealized reference signals using noise in additive and multiplicative form as degradation signals. Different kinds of tests for preference intelligibility, rank ordering and loudness are reported which were utilized to study several aspects of speech quality. Author (TAB)

N66-30634# Mitre Corp., Bedford, Mass.
THE RELATIVE MOTION BETWEEN A RADAR AND A SATELLITE OBJECT
S. H. Bickel Bedford, Mass., AFSC, Electron. Systems Div., May 1966 24 p refs
(Contract AF 19(628)-5165)
(MTR-67; ESD-TR-66-87; AD-633054) CFSTI: HC $1.00/MF $0.50

The relative motion between an earth-based radar and a satellite object is of interest for radar-tracking studies, signature simulation studies, and for developing inverse scattering techniques. Here, the motion analysis is accomplished with elementary vector algebra. This approach results in considerable simplification of the final equations and relationships. Author (TAB)

N66-30642# Smyth Research Associates, San Diego, Calif.
TRANSEQUATORIAL "F" LAYER STUDY Interim Report, Dec. 1965–Feb. 1966
James L. Heritage and Edwin D. Bowen Griffiss AFB, N. Y., RADC, Apr. 1966 43 p
(Contract AF 30(602)-3379)
(SRA-503; RADC-TR-66-218; AD-633428) CFSTI: HC $2.00/MF $0.50

Three months' data have been collected in a study of transequatorial F-layer radio propagation in the Far East. Three 24-hour transmissions per week are made from Okinawa on frequencies from 34 to 90 MHz and received at Darwin, Australia and Lautoka, Fiji Islands. The Okinawa–Darwin path is 4,300 km long, symmetrically displaced about the magnetic equator; it lies in a magnetic meridian plane. The Okinawa–Fiji path is 7,300 km long and cuts across the magnetic equator at an angle of 36 degrees. The months of December 1965, and January and February 1966 were typical of the solstice period—regular midday reception on both paths on 34 MHz but little activity on the higher frequencies. Occasional VHF openings occurred at Darwin but seldomly at Fiji. With the approach of the equinox, March provided a dramatic increase of VHF activity at Darwin with frequent nighttime transmission of frequencies up to 77 MHz. Fiji VHF reception has also become more active but on a reduced scale relative to Darwin—only one case of 54 MHz reception to date. The CW recording is working well with reliable acquisition of signals every time an opening occurs. Fair success has been achieved with the special experiments aimed at propagation mode identification. Pulse resolution of multipaths and angle of arrival measurement are producing results but need further development. Author (TAB)

N66-30646# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
BROADBAND OMNIDIRECTIONAL ANTENNAS
Marvin L. Wahl Nov. 1965 113 p refs
(Contract DA-28-043-AMC-00379(E))
(EDL-M890; AD-633100) CFSTI: HC $4.00/MF $0.50

The report summarizes the research and development work performed in the area of small, broadband omnidirectional antennas. The specific antennas involved have been the spiral conical and biconical, biconicals with polarizing grids placed in the aperture, and aerodynamic discone, and an omnidirectional form of the log-periodic. Newly developed techniques are described, including varactor-tuning the hula hoop antenna to extend the effective bandwidth and the development of a computer program to yield the precise configuration of matching networks to be used with windband monopoles. Author (TAB)

N66-30648# New Mexico State Univ., University Park. Physical Science Lab.
TELEMETRY ANTENNA FOR AE 7.347 INFLATABLE SPHERE EXPERIMENT Scientific Report No. 6
H. W. Haas and D. G. Henry Dec. 1965 44 p
(Contract AF 19(628)-3229)
(AFCRL-66-201; P-T00438; AD-633025) CFSTI: HC $2.00/MF $0.50

Radiation pattern and impedance data are presented for two different telemetry antenna types to be used on a one meter sphere. The sphere is to be ejected from a Niro rocket. The final design must fit in a metal strut contained within the sphere. The model 24.004 antenna is the antenna selected. This antenna was tested for radiation pattern, impedance, and mechanical stability. Data is presented in graphs and photographs. Author (TAB)

N66-30668# Sylvania Electric Products, Inc., Waltham, Mass. Applied Research Lab.
EXPERIMENTAL STUDIES OF NONLINEAR PLASMA EFFECTS WITH SLOT ANTENNAS IN IONIZED HELIUM Scientific Report No. 1
M. H. Mentzoni and J. Donohoe 25 Mar. 1966 50 p refs
(Contract AF 19(628)-5718)
(AFCRL-66-247; AD-632794) CFSTI: HC $2.00/MF $0.50

Pulsed RF breakdown for a slot antenna was investigated. In particular, the formative time lag for breakdown, τ was measured as a function of gas pressure, power level, pulse repetition rate, pulse width, and imposed preionization level. Measurements revealed that breakdown initially occurs only after a large number of pulses according to an accumulative electron density buildup scheme which is statistical in nature. The relationship between τ and power and pressure was similar to what was measured in waveguides with the breakdown field strength nearly equal to the maximum field in the waveguide feeding the antenna. τ increased markedly with the time between pulses, T, particularly at the lower pressures. After a few milliseconds τ increased linearly with T consistent with an exponential decay of the plasma sheath and diffusion being the only electron removal process during the formative time lag. Various imposed preionization levels were furnished by striking a pulsed dc discharge to the ground plane of the antenna and selecting various times, T, during the afterglow for the high power RF illumination. The density across the central portion of the DC discharge vessel was measured by microwave diagnostic techniques. τ increased by decreasing N_0^1 and increasing T; the relationship between τ and T was found to be linear indicating an exponential decay of the local electron. Author (TAB)

N66-30681# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
TRANSIENT WAVE PROPAGATION IN AN INHOMOGENEOUS MEDIUM Scientific Report No. 264
Michael A. Gray 20 Jan. 1966 55 p refs
(Contract AF 19(628)-4014; Grant NSF GP-5611)
(AFCRL-66-264; AD-632664) CFSTI: HC $3.00/MF $0.50

Electromagnetic wave propagation in a medium with an exponentially increasing charge density is studied. Both transmitted and reflected fields are found in the case of plane, monochromatic waves. The use of the bilateral Laplace transform allows the transforms of the transmitted and reflected fields to be found in the case of a step-function excitation moving with velocity C_0 previous to entering the exponential medium. The reflected and transmitted fields are found explicitly when the Bessel functions obtained as solutions can be expanded asymptotically for small argument. Author (TAB)

N66-30695# Mitre Corp., Bedford, Mass.
THE USE OF RESETTABLE INTEGRATORS OR CONVENTIONAL FILTERS IN TIME-DIVISION DATA TRANSMISSION SYSTEMS
Bertram M. Hadfield and Ronald T. Herman Bedford, Mass., AFSC, Electron. Systems Div., May 1966 43 p refs
(Contract AF 19(628)-5165)
(TM-3836; TM-3836, Rev. 1; ESD-TR-65-409; AD-633144) CFSTI: HC $2.00/MF $0.50

This report establishes the 'effective noise power bandwidths' and 'noise reduction factors' of a resettable integrator and of conventional passive lowpass filters. It then discusses the use of the resettable integrator with its necessary sample and hold circuit, as compared to the use of a passive lowpass filter which follows the receiver demodulator in time-division data transmission systems, such as telemetry links. It is concluded that since the overall lowpass bandwidth is determined by the conventional output lowpass filter necessary for removing the sampling 'noise' (quantum steps), then any other filter device is redundant, provided the demodulator does not sensibly alter the statistical properties of the input random noise. As a germane and highly important side issue, a more logical method for selecting the sampling rate in time-division systems is also discussed. Author (TAB)

N66-30703# Polytechnic Inst. of Brooklyn, N. Y. Microwave Research Inst.
EXPERIMENTAL RESULTS OF PSEUDO-RANDOM DOT SCAN Final Report, Phase II, Oct. 15, 1963–Nov. 30, 1965
Sid Deutsch, Philip Balaban, and Abraham Atzmon Jan. 1966 81 p refs
(Contract AF 19(628)-3815)
(PIBMRI-1308-66; AFCRL-66-130; AD-632855) CFSTI: HC $3.00/MF $0.75

The experimental results for five different pseudo-random dot scan television systems are given. The system bandwidths are 1 mc/sec, 62 kc/sec, 8 kc/sec, 2 kc/sec, and 240 cps. Author (TAB)

N66-30705# Mitre Corp., Bedford, Mass.
STUDIES OF DISPLAY SYMBOL LEGIBILITY. PART V: THE EFFECTS OF TELEVISION TRANSMISSION ON THE LEGIBILITY OF COMMON FIVE-LETTER WORDS
Gary Kosmider Bedford, Mass., AFSC, Electron. Systems Div., May 1966 20 p refs
(Contract AF 19(628)-5165)
(W-07450; ESD-TR-65-135; AD-633261) CFSTI: HC $1.00/MF $0.50

The legibility of common five-letter words was studied under four conditions: with solid-stroke letters, and with 10, 7 and 5 horizontal scan lines per character height on a television monitor. Twelve subjects were shown 100 words, one at a time, under controlled conditions. The subject's task was to recite each word as quickly and as accurately as possible. Analysis of the errors and reaction times showed that the legibility of the words significantly decreased as the number of lines decreased. Using the mean reaction time of the solid condition as a base, there is a 32% increase in mean reaction time for the 10-line television presentation, 40% using 7 lines and 85% using 5 lines. Author (TAB)

N66-30713# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
FUNDAMENTAL SCATTERING PARAMETERS OBTAINED FROM LOW-N DATA
Sandra W. Hawley, Thomas H. Kays, and Victor Twersky 1 Nov. 1965 80 p refs
(Contract DA-28-043-AMC-00279(E))
(EDL-M808; AD-633099) CFSTI: HC $3.00/MF $0.75

Scattering measurements on random distributions are often undertaken to obtain information on the properties of the component scatterers. One seeks to isolate the scattering amplitude (the angle dependent part of the usual far-field form) of a component scatterer, particularly its forward scattered value $f=\mathrm{Re}\, f+i\, \mathrm{Im}\, f$. Conventional techniques provide data on the average total intensity and on the coherent phase. Under the best of conditions, coherent intensity and phase data for sparse distributions of concentration ρ enable one to determine $\rho\, \mathrm{Re}\, f$ and $\rho\, \mathrm{Im}\, f$. To isolate f by intensity and phase measurements, one must therefore have some supplementary means of determining ρ. Alternatively, other average scattering functions of the distribution can be sought

which involve Ref, Imf, and ρ differently. In particular, as shown previously, the magnitude on the covariance of the phase-quadrature components of the field depends essentially on $\rho|f|^2$. The theory for isolating f independently of ρ is summarized, and several procedures are illustrated by millimeter wave data obtained for different random distributions of spheres. Author (TAB)

N66-30751*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.

ORGANIZATION OF A DIPOLE PHASED ARRAY ANTENNA

L. A. Jacobson [1966] 34 p

(Contract NASr-249)

(NASA-CR-76257; CSR-TR-66-4) CFSTI: HC $2.00/MF $0.50 CSCL 09F

A unique dipole phased array antenna has been proposed which utilizes microelectronics distributed throughout the array. The objective of this paper is to discuss the initial signal processing and logical organization of the distributed system. Some of the relationships between signal distribution methods, number of components, wire lengths, inherent errors and computation economics are derived and their trade-offs discussed. Although the relationships derived are applicable to an array of aribtrary size and shape, an example of a square 4000 element array is used in the conclusion to illustrate the application of these relationhips. Author

N66-30767*# Purdue Univ., Lafayette, Ind. Electronic Systems Research Lab.

JOINTLY OPTIMUM WAVEFORMS AND RECEIVERS FOR CHANNELS WITH MEMORY

J. C. Hancock and E. A. Quincy Apr. 1966 86 p refs

(Grants NsG-553; NSF GP-2898)

(NASA-CR-76288; TR-EE66-7) CFSTI: HC $3.00/MF $0.75 CSCL 09F

The jointly optimum set of transmitted waveforms and receiver structure which minimizes average probability of error are considered when errors are due to additive noise and intersymbol interference and for which the channel characteristics are known and time-invariant. The Bayes zero-memory receiver structure and formulation of probability of error are given for binary channels with M bauds of memory, and memory is restricted to unity to permit the numerical integration of the probability of error. An equivalent criterion to minimum average probability of error, derived from the error curves, maximizes energy transferred through the channel while constraining the cross-correlation energy between the head and tail of the channel output. The optimum signal for any arbitrary channel is the eigenfunction corresponding to the maximum of a symmetric integral operator. A numerical algorithm is given for solving the integral equation for the optimum signal for an experimental channel impulse response. M.W.R.

N66-30796*# Ohio State Univ. Research Foundation, Columbus. Antenna Lab.

[THEORETICAL AND EXPERIMENTAL STUDIES OF ANTENNAS FOR REFLECTOMETER APPLICATION] Semi-annual Status Letter, 1 Dec. 1965-31 May 1966

6 Jun. 1966 9 p

(Grant NGR-36-008-048)

(NASA-CR-76328) CFSTI: HC $1.00/MF $0.50 CSCL 09F

During this period work was conducted on the reflection coefficient of a parallel plate waveguide in the presence of a metallic plate, and on the aperture admittance of a circular waveguide radiating into a homogeneous dielectric slab. R.N.A.

N66-30850*# Auburn Research Foundation, Inc., Ala.

AN INVESTIGATION OF THE DESIGN CRITERION FOR A PHASE STABILITY STUDY SYSTEM OF VLF PROPAGATION OVER SHORT DISTANCES Technical Report No. 9

E. R. Graf 15 Dec. 1965 85 p refs

(Contract NAS8-5231)

(NASA-CR-76356) CFSTI: HC $3.00/MF $0.75 CSCL 09F

This report describes a system for the measurement of the phase stability of a VLF signal radiated over a short distance; such a system is independent of the incidental phase errors of the associated transmission equipment, and is a function only of the propagation medium. Amplitude stability of the VLF signal can be measured together with the inherent phase errors introduced by transmitting antennas caused by wind loading, temperature, etc. Author

N66-31026# Sandia Corp., Albuquerque, N. Mex.

THE TRANSMISSION AND RECEPTION PROPERTIES OF AN EQUATORIAL SLOT ANTENNA ON A RE-ENTRY SPHERE

Charles W. Harrison, Jr. and Clayborne D. Taylor Nov. 1965 57 p refs

(Contract AT(29-1)-789)

(SC-R-65-992) CFSTI: HC $3.00/MF $0.50

The reentry vehicle model employed in this study consists of a plasma clad sphere with a narrow circumferential slot cut at the equator. The slot is excited by a biconical transmission line driven at its center by a coaxial cable. The homogeneous plasma may be in contact with the sphere or an insulating barrier interposed between the sphere and the plasma sheath. The driving point impedance referred to the input terminals and the radiation field in terms of the input current are determined. The efficiency of transmission is calculated by taking the ratio of the power obtained by integrating the Poynting vector over the surface of a great sphere to the power supplied the linearly tapered radial transmission line by the coaxial cable. The voltage appearing across an impedance connected to the terminals of the biconical transmission line is evaluated in terms of the amplitude of an incident plane wave electromagnetic field. Extensive numerical results are presented exhibiting the transmission and reception qualities of the equatorial slot antenna on the reentry sphere, when the plasma is in contact with the vehicle, for a range of frequencies and plasma properties. Author (NSA)

N66-31097# RAND Corp., Santa Monica, Calif.

ECONOMIC PROBLEMS OF ESTABLISHING A COMMUNICATIONS SATELLITE SYSTEM

Leland L. Johnson Oct. 1962 10 p Presented at the Subcomm. on Monopoly of the Senate Select Comm. on Small Business, 3 Aug. 1961

(P-2647; AD-625351) CFSTI: HC $1.00/MF $0.50

Four types of monopolistic ownership for a U.S. Satellite System are considered: (1) system owned and operated exclusively by U.S. international common carriers; (2) system owned and operated by these carriers and satellite equipment manufacturers; (3) system owned by neither of these but by

a diversity of stockholders who generally have no direct business ties in the communications field, this firm selling voice channels to the common carriers; and (4) a system owned and operated by the government that would sell channels to common carriers. The U.S. is stated to have the problem of deciding whether: (1) to develop a system for a large number of countries, particularly underdeveloped ones, this probably including a large number of satellite ground stations in many smaller nations; or, (2) to establish relatively few large ground stations around the world in major population centers in order to tie together the major land masses and then connect the underdeveloped countries into the worldwide system by conventional land line. TAB

N66-31120# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRONIC PHOTOGUIDE

L. V. Kasanfomaliti 8 Oct. 1965 6 p refs Transl. into ENGLISH from Byul. Abastumani Astrofiz. Observ. (USSR), no. 30, 1964 p 137–138

(FTD-TT-65-1421/1+4; TT-65-64137; AD-622345) CFSTI: HC $1.00/MF $0.50

A system is proposed for automatic tracking by telescope, based on the dissector LI-601 television transmitter tube. TAB

N66-31132# Columbia Univ., N. Y. Dept. of Electrical Engineering.

V-LINE SURFACE WAVE RADIATION AND SCANNING Scientific Report No. 85

Paul Diament, Stephen L. Richter, William L. Lupatkin, and S. Perry Schlesinger 24 Aug. 1965 36 p refs

(Contract AF 19(628)-2461)

(AFCRL-65-725; AD-626762) CFSTI: HC $2.00/MF $0.50

The feasibility of converting a surface wave propagating structure, the V-line, into an end-fire or broadside radiator is analyzed theoretically and demonstrated experimentally. It is shown that the radiation may be considered, under suitable design and launching conditions, to be associated with a higher-order hybrid mode of propagation of the cylindrical dielectric rod. End-fire radiation induced by axial truncation and broadside radiation from a parasitic linear array are predicted and verified. A radiation scanning situation simulating electrical control of beam position by varying the permittivity of the binding element is illustrated and discussed critically. Author (TAB)

N66-31133# State Univ. of New York, Stony Brook. Coll. of Engineering.

A PHASE-INTEGRAL APPROXIMATION FOR THE CURRENT DISTRIBUTION ALONG A LOG-PERIODIC ANTENNA Scientific Report No. 1

Richard B. Kieburtz 16 Mar. 1965 9 p ref /ts Tech. Rept.-37

(Contract AF 19(628)-4144)

(AFCRL-65-799; AD-626696)

The variation of current with distance from the apex along the feed line of a log-periodic antenna is considered. The current distribution is found to be given approximately by a phase-integral formula in which the differential phase increment is related to the propagation constant on the prototype periodic structure. Conditions for the validity of the phase-integral approximation are investigated. These conditions are that the spacing between adjacent radiating elements is much less than the wavelength, and that the logarithmic increment in the phase constant from one cell of the structure to the next is much smaller than unity. Author (TAB)

N66-31134# Syracuse Univ. Research Inst., N. Y. Dept. of Electrical Engineering.

INPUT VSWR MINIMIZATION FOR A TRANSMISSION LINE WITH MULTIPLE DISCONTINUITIES

James G. Rudolph and David K. Cheng Griffiss AFB, N. Y., RADC, Dec. 1965 31 p refs

(Contract AF 30(602)-2646)

(EE957-6504T11; RADC-TR-65-171; AD-626327) CFSTI: HC $2.00/MF $0.50

A technique using an isometric-circle interpretation of a bilinear transformation has been developed for minimizing the input VSWR of a transmission line consisting of multiple discontinuities joined by line sections. It makes possible the determination not only of the minimum attainable input VSWR but also of the required line lengths between the successive discontinuities. The case for N real and equal discontinuities is particularly simple, and the necessary conditions for obtaining a perfect match are established. Numerical examples are given. Author (TAB)

N66-31144# Hughes Aircraft Co., Fullerton, Calif.

INVESTIGATION OF USE OF SUPERIMPOSED SURFACE WAVE MODES Final Report No. 1, 1 Feb. 1965–31 Jan. 1966

N. S. Wong, S. Sheaffer, and R. Tang 28 Feb. 1966 90 p refs

(Contract AF 19(628)-4984)

(AFCRL-66-200-I; AD-631936) CFSTI: HC $3.00/MF $0.75

A novel method of achieving a matched radiating element in a phased array antenna over a specified scan angle has been investigated. The radiating element consists of an open-ended waveguide supporting the two lowest order modes. Each of these modes excites a surface wave along the array. When appropriately super-imposed, the two surface waves yield the correct shape of mutual impedances which produce a constant driving point impedance over a specified scan angle when all elements in the array are driven. The existence of these surface waves has been verified by the experimental investigations. The near fields, both of the radiation and the induction types, were shown to be important under certain conditions. Using a scattering formulation instead of impedance formulation, this method of control of driving point impedance can be regarded as combining two or more modes such that the reflections of these modes tend to cancel each other at the driven terminals. A VSWR of less than 1.2 to 1 over a ±60° scan angle from broadside was obtained theoretically for a linear array of open-ended waveguides supporting the two lowest order modes. Author (TAB)

N66-31152# Pickard and Burns Electronics, Waltham, Mass.

OMEGA, A WORLD-WIDE NAVIGATIONAL SYSTEM: SYSTEM SPECIFICATION AND IMPLEMENTATION Second Revision

J. A. Pierce (Harvard Univ.), W. Palmer (Sperry Gyroscope Co.), A. D. Watt (Deco Electronics, Inc.), and R. H. Woodward 1 May 1966 284 p refs Prepared Jointly with Harvard Univ., Sperry Gyroscope Co., and Deco Electronics, Inc. Supersedes AD-603764

(Contracts Nonr-1866(07); Nonr-4173(00); Nonr-4107(00); Nonr-4105(00))

(P&B-886B; AD-630900; AD-603764) CFSTI: HC $7.00/MF $1.75

This report presents a design plan for a radio-locating facility providing world-wide position fixing of moderate (one-mile) accuracy by phase comparison of VLF (10–14 kc) continuous wave radio signals from only eight strategically located transmitting stations usable by aircraft, ships, and land vehicles, and by submarines at moderate (40–50 feet) antenna depths. TAB

N66-31154*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ASEE–UNIVERSITY OF MARYLAND–CATHOLIC UNIVERSITY NASA SUMMER FELLOWSHIP PROGRAM Final Report
Jan. 1966 107 p refs
(NASA-TM-X-55504; X-520-66-3) CFSTI: HC $4.00/MF $0.75 CSCL 09F

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N66-31155*# Clemson Coll., S. C.
DIGITAL FILTER DESIGN
William D. Stanley *In* NASA. Goddard Space Flight Center ASEE–Univ. of Md.–Catholic Univ.–NASA Summer Fellowship Program Jan. 1966 p 1–26 refs (See N66-31154 17-07) CFSTI: HC $4.00/MF $0.75

A design study is presented for constructing numerical algorithms of digital filters. These algorithms will be used to convert a digital computer into a digital filter for altering the spectral representation of sampled data. The procedures discussed, it is noted, depend on the bilinear transformation to map an analog domain response in the digital domain. The approximation problem is first performed in the analog domain using conventional network synthesis tables, and then this response is mapped into the digital domain. The use of the z-transform results in a numerical algorithm that can be easily programmed onto a computer. Techniques are included both for low pass and band pass filters. D.T.

N66-31156*# Massachusetts Univ., Amherst.
DESIGN PROBLEMS IN A CONTROL SYSTEM USED FOR PRECISE OPTICAL TRACKING OF SATELLITES AND STARS
Richard V. Monopoli *In* NASA. Goddard Space Flight Center ASEE—Univ. of Md.—Catholic Univ. NASA Summer Fellowship Program Jan. 1966 p 27–42 refs (See N66-31154 17-07) CFSTI: HC $4.00/MF $0.75

A pulse model suitable for Z transform analysis of the system was developed. It shows that system operation is exactly as desired when secondary effects are neglected. The analysis of reference input requirements showed that in order to satisfy error requirements, inputs must be applied at least once every .282 seconds or, alternatively, rate and acceleration inputs must be used. Bearing friction was revealed as the most likely cause of the limit cycles observed while operating in the rate mode. A design was presented which should overcome these limit cycles. It was based on increasing the digital tach loop damping, lowering its bandwidth and incorporating a feedforward path. This design requires only minimum modification of existing equipment. Author

N66-31157*# Pratt Inst., Brooklyn, N. Y.
TRACKING ACCURACY ANALYSIS OF THE 85-FOOT PARABOLIC ANTENNA AT ROSMAN, NORTH CAROLINA
Couros Ghaznavi and Teodoro Mercado-Jimenez (Puerto Rico Univ.) *In* NASA. Goddard Space Flight Center ASEE—Univ. of Md.—Catholic Univ. NASA Summer Fellowship Program Jan. 1966 p 43–62 refs Prepared jointly with Puerto Rico Univ. (See N66-31154 17-07) CFSTI: HC $4.00/MF $0.75

The object of this study is to find the limitations of the 85-foot antenna tracking system at Rosman, North Carolina, and to suggest some possible modifications to the system in order to meet a specified accuracy of 0.01 degree. This accuracy which corresponds approximately to a system frequency of 8.000 Mc should also be attained for low altitude satellites. The error caused by satellite motion was calculated. It was found that this error is not negligible for low altitude (100 miles) satellites. A signal adaptive technique is proposed to reduce the tracking error. The effects of wind torques and noise disturbances were also considered. As the effect of noise in the system error is dependent on the magnitude of the noise spectrum, a limit may be set in order to satisfy the required accuracy. It is shown that an adaptive system could reduce the error due to the noise. Author

N66-31160*# Newark Coll. of Engineering, N. J.
CORRELATION BETWEEN JITTER AND INFORMATION RECOVERY IN PCM TELEMETERED DATA
Paul Goodman *In* NASA. Goddard Space Flight Center ASEE—Univ. of Md.—Catholic Univ. NASA Summer Fellowship Program Jan. 1966 p 89–93 (See N66-31154 17-07) CFSTI: HC $4.00/MF $0.75

A method was established and equipment was devised for producing as output, from a PCM signal which contains data, a single number which would reliably predict the relative ease or difficulty of recovering error free data from a magnetic tape. This method allows greater care during the processing of tapes predicted to be difficult; and conversely, poor data recovery from a tape predicted to be excellent would indicate malfunctioning of the data processing equipment. D.T.

N66-31170# Michigan State Univ., East Lansing. Div. of Engineering Research.
MINIMIZATION OF END-FIRE RADAR ECHO OF A LONG THIN BODY BY IMPEDANCE LOADING

Kun-Mu Chen Oct. 1965 24 p refs Prepared for Mich. Univ.
(Contract AF 33(615)-1656)
(TR-4; AD-623729) CFSTI: HC $1.00/MF $0.50

A theory of the minimization of the end-fire radar echo of a long, thin body by an impedance loading technique is presented. When a long, thin body is illuminated by a plane wave in the region of longitudinal incidence, a large back scatter is observed. This back scatter is due to the induced traveling wave which is reflected from the rear end of the body. By an appropriate impedance loading, this back scatter can be minimized. In this paper, the induced current on a long, thin and loaded cylinder is studied. The optimum impedance loading which minimizes the endfire radar echo is explicitly obtained. Theoretical results are compared with the experimental data and an excellent agreement is obtained.
Author (TAB)

N66-31213*# Collins Radio Co., Cedar Rapids, Iowa.
SIGNAL FADING CHARACTERISTICS, ECHO II
Washington, NASA, Jul. 1966 108 p
(Contract NAS5-9648)
(NASA-CR-528) CFSTI: HC $4.00/MF $0.75 CSCL 17B

This report contains an analysis of the fading of the Echo II satellite radio cross section. Fade duration and fade period probability distribution and density functions were obtained at various cross section levels. The results of the analysis indicate that the fading characteristics of Echo II did not change noticeably over the first year from launch. The fading of Echo II is similar to that observed on other communication links.
Author

N66-31216*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-39, VOLUME III FOR THE PERIOD MARCH 1 TO APRIL 30, 1966. THE DEEP SPACE NETWORK
31 May 1966 132 p refs
(Contract NAS7-100)
(NASA-CR-76379; JPL-SPS-37-39, Vol. III) CFSTI: HC $4.00/MF $1.00 CSCL 09F

Details are given on the continuing research and development efforts directed toward the Deep Space Network (DSN) ground communications system. Tracking and navigational accuracy analyses are presented, covering such problems as DSIF (Deep Space Instrumentation Facility) data types and tracking modes, and two-way Doppler inherent accuracy limitations; Apollo and Pioneer project support; information content of a single pass of Doppler data; and postflight tabulation of the Mariner IV real-time orbit determination errors. A simplified idealization of the DSN communications system model is also presented as an example for determining error transmission. Efficient data systems, such as a teletype coding experiment and a multipurpose digital autocorrelator for the DSN, are considered, along with digital communication tracking problems. The S-band implementation for the DSIF as an acquisition aid for the spacecraft guidance and command station is discussed, and the microwave link between Venus and Mars stations is evaluated. Flight project support, and facility construction and equipment installation are outlined. M.G.J.

N66-31217*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
DESIGN, DEVELOPMENT, TESTING AND FLIGHT PERFORMANCE OF MARINER MARS PLANETARY SCAN SYSTEM
Robert Y. Wong 1 Jul. 1966 69 p refs
(Contract NAS7-100)
(NASA-CR-76380; JPL-TR-32-919) CFSTI: HC $3.00/MF $0.75 CSCL 09F

This report describes the design, development, fabrication, testing, and performance of the Mariner planetary scan system. Its functions are to search for, acquire, and track the planet Mars to orient the television camera properly during the period immediately preceding the television picture recording sequence. The system was designed to scan an instrument platform 180° in the process of searching for the planet. The scanning provides motion in one direction while the moving spacecraft on its trajectory provides motion perpendicular to the scanning plane. Limit switch action produces signals to reverse the scan direction at the end of each 180° sweep. Planet acquisition and tracking are accomplished by a radiation detector with optics having a 50° circular field of view. The detector senses the planet's presence and its position relative to the spacecraft. When the planet comes into the detector's field of view, the system switches to planet tracking operation and proceeds such that the desired portion of the planet is used as the nulling plane for the servo system. To indicate the planet's acquisition, a planet-in-view signal is telemetered to earth in real time and is also used to switch the spacecraft data mode to planet encounter format.
Author

N66-31223*# Maryland Univ., College Park. Dept. of Physics and Astronomy.
THE DESIGN OF LARGE STEERABLE ARRAYS USING VOLTAGE-VARIABLE CAPACITORS Status Report, Oct. 1, 1965–Mar. 31, 1966
M. M. Komesaroff Jun. 1966 33 p ref
(Grant NsG-615)
(NASA-CR-76371) CFSTI: HC $2.00/MF $0.50 CSCL 09F

A method is proposed for building a rapidly steerable high resolution antenna array, suitable for radio astronomy. The method employs voltage variable capacitors spaced at equal intervals along the transmission line of a "travelling wave" array. Steering is accomplished by varying a dc voltage applied between the transmission line conductors. The technique is most readily applicable at decameter wavelengths, since the necessarily low ohmic efficiency of the system is not a drawback at these wavelengths. It could, however, also be used at shorter wavelengths since integrated circuit amplifiers make it possible at relatively low cost, to amplify the output of each antenna element before coupling it into the transmission line.
Author

N66-31250# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AMPLITUDE ANALYSIS PROGRAM Technical Note No. 1966-1
Florence Wilson 29 Apr. 1966 59 p
(Contract AF 19(628)-5167; ARPA Order 600)
(ESD-TR-66-198; AD-632997) CFSTI: HC $3.00/MF $0.50

The amplitude analysis programs were written to produce an average pulse shape over a reasonable time interval for up to 200 range stations behind the tracked target leading edge and a frequency distribution of cross section at each station over the time period. The final output is presented as Stromberg–Carlson 4020 plots of average pulse and distributions. The input is obtained by digitizing A-Scope films on the Group 21 High Precision computer controlled film reader, filtering this data with a ramp filter to locate the position of the tracked target leading edge, and then writing a tape containing only that data behind the leading edge. The Amplitude

Frequency Distribution and Statistical Program uses this filtered output tape and computes an average pulse and the standard deviation from this pulse at each desired range station over a given time interval and also finds the distribution of cross section at each range station, if desired. A tape containing this information is then used as input to the Amplitude Plotting Program which produces the Stromberg–Carlson 4020 plots. The present report contains a summary of the method of obtaining the input data, the mathematics involved, a description and listing of the two programs, and directions for running the programs. Author (TAB)

N66-31253# Navy Underwater Sound Lab., New London, Conn.

THE EFFECT OF WIND SPEED ON THE SPATIAL CORRELATION OF AMBIENT NOISE

Beverly C. Hassell and Frank J. Keltonic 9 May 1966 15 p refs

(USL-727; AD-632912) CFSTI: HC $1.00/MF $0.50

Measurements of spatial correlation of ambient noise have been made in Bermuda over an 18-month period by means of a deep-water, bottom-mounted, vertical hydrophone array. Comparisons of these mean correlation values with theoretical values, which are based upon a surface-generated directional noise model, have been made for four frequency bands with wind speed as a parameter. The experimental and theoretical values show excellent agreement for frequency bands of 400–600 cps, 600–800 cps, and 800–1000 cps, regardless of the wind-speed conditions. For the frequency band of 200–400 cps, the agreement is wind-speed dependent: better agreement is obtained at the higher wind speeds. These results serve to verify the applicability of the noise model for the higher frequencies (400–600 cps, 600–800 cps, and 800–1000 cps) and for the low frequencies (200–400 cps) when the surface noise levels are high enough to predominante over any horizontal noise components. Author (TAB)

N66-31256# New York Univ., N. Y. Lab. for Electroscience Research

WORD-SELECTION PROCEDURES FOR ERROR-FREE COMMUNICATION SYSTEMS Second Scientific Report

John J. Metzner and Kenneth C. Morgan Jun. 1965 82 p refs *Its* Tech. Rept.-400-113

(Contract AF 19(628)-4321)

(AFCRL-65-461; AD-621323) CFSTI: HC $3.00/MF $0.75

This report describes three alternative sets of rules, or procedures, capable of regulating the flow of message words in a feedback communication system—the circulating memory procedure, the interlace procedure, and the 'go back' procedure. The first two of these have been mentioned briefly in previous reports and the third has been described elsewhere. The procedures are evaluated and compared with respect to complexity and storage requirements, operational logic, and compatibility with cumulative decision techniques. A preliminary study of their effect on transmission time and hence on system efficiency is also presented. Author (TAB)

N66-31289# Institute for Defense Analyses, Arlington, Va. Research and Engineering Support Div.

RADAR RETURN FROM VEHICLES IN THE IONOSPHERE

S. Rand and F. Albini Nov. 1965 35 p refs *Its* Res. Rept.-P-225 Presented at the 2d Symp. of the Am. Astronautical Soc. on "Interactions of Space Vehicles with an Ionized Atmosphere," Miami, Fla., 26–27 Sep. 1965

(Contract ARPA SD-50; Proj. Defender)

(IDA/HQ-65-4474; AD-632915) CFSTI: HC $2.00/MF $0.50

Approximate expressions are derived for radar (backscatter) cross sections of the wakes of vehicles in the ionosphere. Vehicle speed is assumed to be much greater than ion thermal speed but much less than electron thermal speed. It is shown that, under broadside incidence conditions, the large region of mild electron depletion behind the vehicle can give rise to backscatter cross sections approaching 100 square meters. The orientation of the velocity vector with respect to the local geomagnetic field is also shown to be important. Author (TAB)

N66-31307# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.

POSITION OF McMURDO SOUND, ANTARCTICA TRACKING STATION AS DETERMINED BY ARTIFICIAL EARTH SATELLITES

F. T. Heuring Jul. 1965 16 p refs

(Contract NOw-62-0604-c)

(TG-714; AD-633006) CFSTI: HC $1.00/MF $0.50

During the antarctic summer (1964–1965) a Doppler tracking station, under cognizance of the United States Antarctic Research Program, National Science Foundation, was installed at McMurdo Sound, Antarctica with equipment furnished by the U. S. Navy. Initial station coordinates were acquired by taking an average value from various sources. Since there are no known triangulation or Hiran ties from Antarctica to any existing datum in the world, it was expected that the coordinates were probably in error with respect to the APL reference systems (Heuring, 1964). This was soon verified after some passes of data were processed by our tracking programs. Herein are described the method and results of refining the position of the McMurdo Sound Doppler Tracking Site. Author (TAB)

N66-31339# Institute for Defense Analyses, Arlington, Va. Research and Engineering Support Div.

ON NORMAL APPROXIMATIONS TO THE ERROR PROBABILITY FOR A CORRELATION RECEIVER IN A HARD-LIMITED CHANNEL

Joseph M. Aein Jan. 1966 44 p refs

(Contract ARPA SD-50)

(P-241; IDA/HQ-66-4565; AD-632917) CFSTI: HC $2.00/MF $0.50

The advent of communication satellites has stimulated interest in signal designs allowing access to a repeater by many independent carriers. To maximize the power efficiency of the satellite, consideration has been given to the use of a repeater which can be characterized as a hard-limited channel. A technique for achieving multiple access to a hard-limited channel is to use constant-envelope, pseudo-noise phase-coded spread-spectrum carriers (p-n carriers) with correlation-type receivers. The interferring signals at the limiter input are modeled as a statistically independent zero mean stationary Gaussian noise process. This paper examines the approximation to normal of the error probability when binary symmetric bit-to-bit independent message sources are received by a coherent stored reference correlator after passing through a hard-limited channel. The approach used here follows that of Shannon and Gallagher for computing the probability tail

with Chernoff bounding techniques. This method avoids the usual objections raised to the Edgeworth series when used to compute an error probability. Subject to restrictions of weak carrier-to-noise ratios at the channel input and error rates less than 10^{-2}, the conclusion reached is that the error probability can be computed, to within the accuracy of the mathematical idealization of a real channel, as if the correlator output were normal. Author (TAB)

N66-31342# Electro-Voice, Inc., Buchanan, Mich.
LIGHT WEIGHT ACCESSORIES First Quarterly Report, 30 Jun.–30 Sep. 1965
B. T. Cochran Jan. 1966 13 p
(Contract DA-28-043-AMC-01542(E))
(ECOM-01542-1; AD-628672) CFSTI: HC $1.60/MF $0.50

The report contains a summary of the work performed for the design and construction of a lightweight and miniature type handset, hand-held microphone, double earphone headset and telegraph key. The report contains a review of the work performed in this period which consisted of designing an acceptable configuration of these items and a satisfactory and acceptable electroacoustical design of the earphone and microphone elements. From the preliminary design, configuration, it appears that the design goal of reducing the weight of each item by 50% will be readily achieved. Also, these configurations will conform to good human engineering design standards. Author (TAB)

N66-31380*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
ADVANCED TELEMETRY SYSTEM WITH ADAPTIVE CAPABILITY Final Technical Summary Report, 1 Jul. 1964–25 Feb. 1966
H. N. Massey 25 Feb. 1966 29 p refs
(Contract NAS8-5110)
(NASA-CR-76402; LMSC-669394) CFSTI: HC $2.00/MF $0.50 CSCL 09F

Design improvements, and experimental tests on the second and third experimental flight packages of an advanced telemetry system with adaptive capability were continued, and functional testing problems and corrective actions completed. This telemetry system acquires data, examines it for redundant properties, and transmits only information actually required for reproducing data variations on the ground. The first experimental package was also retrofitted to provide a reference memory storage capacity of 480 words. It is considered that the feasibility of this advanced system for application in a space vehicle environment has been adequately demonstrated, and that implementation of this system will reduce the bandwidth required to transmit the data and/or increase the amount of data that may be transmitted in a specified bandwidth. R.Ll.

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N66-30002# Polytechnic Inst. of Brooklyn, N. Y. Electrical Engineering Dept.
QUASI-LINEAR SEQUENTIAL MACHINES
Pierre Lavallee Feb. 1966 99 p refs
(Contract AF 49(638)-1402)
(PIBMRI-1315-66; AD-632602) CFSTI: HC $3.00/MF $0.75

A class of sequential circuits, in which the next state and output functions are linear functions of the present state and non-linear functions of the inputs, is analyzed. The problem of deciding if an arbitrary sequential machine belongs to this class, is solved using cyclic and transient binary partitions generated by the output variables. Special cases of this class, such as the linear machines, and machines which perform multiplication and division in finite fields are considered as quasi-linear machines with a special coding of the input combinations. This class of machines is shown to possess very short diagnosing sequences of length at most N, for a Q state machine. A procedure is presented whereby any sequential machine is simulated by a quasi-linear machine using a minimum number of extra delay elements over and above that needed for non quasi-linear realization. Finally a computational algorithm is developed for the detection of a quasi-linear next-state assignment for a machine with a non-quasi-linear output function. Author (TAB)

N66-30058# Joint Publications Research Service, Washington, D. C.
A DIGITAL FOLLOWING SYSTEM WITH PROPORTIONAL CONTROL
V. T. Sharovatov and A. S. Bushlya *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 86–91 (See N66-30046 17-10) CFSTI: $5.00

Attention is given to a digital following system (TsSS) and its basic units: the circuit of the calculating unit with a "shaft-encoder" converter, the circuit of the comparator unit (summator), the circuit of the decoding unit, and the arrangement for reversing the operating motor. In the TsSS system the signal for the control of the operating motor depends on the value and sign of the error. It is necessary to determine by means of the summator the difference code corresponding to the actual error value, and convert it into a voltage. This type of TsSS is convenient to utilize as an output device for certain digital computers used in automatic control systems. The limits of the static accuracy of TsSS depend only on the precision of the "shaft-encoder" converter reducer, since the converter error can be very small when the number of bits is increased. Author

N66-30119*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A USERS' GUIDE FOR SEARCH AND ITER
N. S. Newhall 15 Apr. 1965 37 p
(Contract NAS7-100)
(NASA-CR-76113; JPL-TM-33-203) CFSTI: HC $2.00/MF $0.50 CSCL 09B

Two computer programs are described in this report: SEARCH, a program to calculate initial values of a trajectory (or any computation) whose end conditions are known, and ITER, an iterative program simulating a "DO-loop" in a source deck. Both programs operate on an IBM 7094 under JPTRAJ, running under either the SFOF or FORTRAN system. Author

N66-30122*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
AN ADAPTIVE NUMERICAL INTEGRATION ROUTINE FOR THE IBM 1620 II

E. H. Kopf, Jr. 1 Jun. 1966 22 p refs
(Contract NAS7-100)
(NASA-CR-76110; JPL-TR-32-982) CFSTI: HC $1.00/MF $0.50 CSCL 09B

This report presents a symbolic programming system (SPS) coded numerical integration program designed to be used as a Fortran subroutine on the IBM 1620 II Computer. The program will solve differential equations by integration starting with known initial conditions. An adaptive option is available where the speed of integration is automatically varied in accordance with a predicted error. Author

N66-30204*# Stanford Research Inst., Menlo Park, Calif.
COMPUTER-AIDED DISPLAY CONTROL Final Report
W. K. English, D. C. Engelbart, and Bonnie Huddart Jul. 1965 112 p refs
(Contract NAS1-3988)
(NASA-CR-66111) CFSTI: HC $4.00/MF $0.75 CSCL 09B

This report presents the initial results of a continuing research study on the computer-aided human control of computer displays. Specifically, this project has been concerned with exploring methods of improving a person's ability to compose and modify text presented on a computer-driven cathode ray tube display. This report includes a description of the on-line system for text manipulation, developed in part by this project and used in the preparation of this report. An approach to the analysis and evaluation of techniques for the control of computer displays is developed and the results of some preliminary evaluative experiments are described. Author

N66-30208# Japan Atomic Energy Research Inst., Tokyo. Tokai Research Establishment.
CODE GRAFA—AN IBM-7044 FORTRAN IV CODE FOR CALCULATION OF THE NEUTRON SPECTRUM FOR SQUARE AND HEXAGONAL LATTICES
Hiroshi Takahashi, Takashi Nakayama, and Tsuneo Tsutsui Nov. 1966 18 p refs
(JAERI-1097)

A description is presented of the GRAFA code written in FORTRAN IV for the IBM 7044. The code computes the scalar thermal neutron spectrum as a function of spatial regions in a square and hexagonal lattice by using the first flight collision probabilities for these geometries. The scattering kernel data calculated by various models are input from the library tape. Author (NSA)

N66-30218# Atomics International, Canoga Park, Calif.
NAA PROGRAM DESCRIPTION—A PROGRAM TO REFORMAT GRAVE/PRISM PUNCHED OUTPUT
R. A. Blaine 15 Jan. 1965 43 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-10884) CFSTI: HC $2.00/MF $0.50

A computer program that was developed to combine the punched output from the GRAVE and PRISM programs for input to several multigroup library preparation codes is described. NSA

N66-30222# Chicago Univ., Ill. Inst. for Computer Research.
INSTITUTE FOR COMPUTER RESEARCH Quarterly Report No. 7
Richard H. Miller 1 Nov. 1965 157 p refs
(Contract AT(11-1)-614)
(COO-614-41) CFSTI: HC $5.00/MF $1.00

A summary is presented of Maniac III engineering and operations; the development of integrated circuits for digital-computer uses; operation of error-function and gamma-function library subroutines; the operation of the instruction "Switch State of Computer" in Maniac III; bit and character addressing in Maniac III; the generation of input matrices for numerical calculations in Maniac III; theoretical investigations of a theorem in switching theory, the uses of Banach-space operators in fixed-point theorems; the decomposition of integer programming problems; and computer uses for chromosome Karyotyping and studies of the adiabatic invariants of stars in the galactic field. NSA

N66-30224# Sandia Corp., Albuquerque, N. Mex.
A COMPUTER PROGRAM FOR PERFORMING RELIABILITY ANALYSES
A. M. Breipohl and R. A. Hernquist Dec. 1965 39 p
(Contract AT(29-1)-789)
(SC-TM-65-523) CFSTI: HC $2.00/MF $0.50

A computer program which will perform system reliability analyses is discussed. The program, after receiving component and wiring diagram information, constructs the dud and premature equations which relate the probabilities of system behavior with the probabilities of the various subsystem (component) behaviors. The ability to evaluate the consequences of electrical shorts in both dud and premature studies, and the ability to obtain component information from such tests as QEST and NMST, were included in the program's logic. The modeling scheme used by a reliability analyst in describing component information for the computer is discussed. Some general comments concerning the treatment of electrical shorts are also included. Author (NSA)

N66-30226# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
STMGEN—A COMPUTER CODE FOR THE DESIGN OF A STEAM GENERATOR Supplement
G. M. Schultz 1965 35 p refs
(Contract AT(04-3)-167)
(GAMD-6675, Suppl. GAMD-6675) CFSTI: HC $2.00/MF $0.50

This report is a supplement to GAMD-6675, entitled "A Computer Code for the Design of a Steam Generator." The design and cost additions that were made to facilitate the use of the code as a sub-program in the optimization code currently under development at General Atomic are discussed. Author (NSA)

N66-30227# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
STMGEN—A COMPUTER CODE FOR THE DESIGN OF A STEAM GENERATOR
G. M. Schultz and D. A. Doering 27 Aug. 1965 149 p
(Contract AT(04-3)-167)
(GAMD-6675) CFSTI: HC $4.00/MF $1.00

STMGEN is a Computer Code written for the IBM-7044 Digital Computer. It is the first of a series of programs that will be used in a plant optimization program. The code will compute the geometry of each section of a steam generator required to satisfy the design conditions. Author (NSA)

N66-30232# European Atomic Energy Community, Brussels (Belgium). European Scientific Data Processing Center.
LINEAR INEQUALITIES ON A TOTAL ORDERED LINEAR INTEGER RING (APPLICATIONS TO THE LINEAR PROGRAMMATION AND TO THE GRAPHS THEORY) [INEGALITES LINEAIRES SUR UN ANNEAU D'INTEGRITE TOTALEMENT ORDONNE (APPLICATIONS A LA PROGRAMMATION LINEAIRE ET A LA THEORIE DES GRAPHES)]
P. Camion 1965 32 p refs In FRENCH
(EUR-1919.f)

A theory of linear programming available on linear ordered integer rings is discussed. It only uses the notion of interval, and not the notion of convexity. By this means, one improves the known results on feasibility of systems of linear inequalities. New algorithms are given in linear programming and it is shown how a whole chapter in graph theory belongs to this theory. Author (NSA)

N66-30239# Atomic Energy Establishment, Winfrith (England). Control and Instrumentation Div.
FIFI 3: A DIGITAL COMPUTER CODE FOR THE SOLUTION OF SETS OF FIRST ORDER DIFFERENTIAL EQUATIONS AND THE ANALYSIS OF PROCESS PLANT DYNAMICS
Helen M. Sumner Nov. 1965 44 p
(AEEW-R-453) HMSO: 7s

FIFI 3 is a FORTRAN Code embodying a technique for the analysis of process plant dynamics. As such, it is essentially a tool for the integration of sets of first order ordinary differential equations, either linear or non-linear; special provision is made for the inclusion of time-delayed variables in the mathematical model of the plant. The method of integration is new and is centered on a stable multistep predictor-corrector algorithm. The theory on which the Code is based and detailed rules for using it are described. Author (NSA)

N66-30306# Joint Publications Research Service, Washington, D. C.
BUILDING COMPUTERS THAT HEAR AND SPEAK
Lev Kokin 6 Jul. 1966 12 p Transl. into ENGLISH from Ogonek (Moscow), no. 12, Mar. 1966 p 14-15
(JPRS-36324; TT-66-32756) CFSTI: $1.00

A general discussion is presented relating to the development of machines that will hear and speak, and teaching machines which can recognize different sounds from different voices are considered. Experiments dealing with the synthesis of speech are mentioned, and the difficulty in bridging the gap between human and machine language is stressed. Mention is made of a machine which will direct persons to other people or to laboratories within a plant. M.W.R.

N66-30322# Joint Publications Research Service, Washington, D. C.
ELECTRONIC CALCULATOR EVBO-3m
G. A. Pechenkin 6 Jul. 1966 11 p Transl. into ENGLISH from the book "Vychisliten'naya Tekhnika na Zheleznodorozhnom Transporte" Moscow, 1965 p 95-99, 108, 109, 115, and 116
(JPRS-36319; TT-66-32751) CFSTI: $1.00

A switchboard-operated high-speed electronic counting-punching machine is described which can use 45- or 80-column cards. Arithmetic and logic operations are performed within an electronic cabinet, and a punching attachment is the input-output device. Despite its limited memory capacity of only 48 decimal categories, this electronic calculator is utilized in mechanized counting factories of railroads to obtain information about freight and passenger operations as well as to mechanize overall bookkeeping procedures. The calculator actually represents a transition stage between electromechanical calculating devices and electronic digital computers. M.W.R.

N66-30381*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROGRAM DOCUMENTATION
Howard R. Stagner Feb. 1966 19 p
(NASA-TM-X-55538; X-564-66-73) CFSTI: HC $1.00/MF $0.50 CSCL 09B

A discussion of programming documentation, the need for it, its functional role, and structure is given, followed by a detailed outline of requirements for complete documentation. Author

N66-30412# Argonne National Lab., Ill.
A CATHODE-RAY-TUBE PLOTTING SYSTEM FOR THE CONTROL DATA 3600 COMPUTER
G. A. Robinson and R. F. Krupp Dec. 1965 21 p refs
(Contract W-31-109-ENG-38)
(ANL-7121) CFSTI: HC $1.00/MF $0.50

The cathode ray tube (CRT) display system used on CDC 3600, including the programming systms developed for CRT plotting, is described. The CRT equipment is attached to the 3600 through a 3606 Data Channel. The data transmitted from the computer are plotted on the CRT in the form of points, lines, or binary-coded decimal characters and are photographed by a 35-mm camera. NSA

N66-30462# Atomics International, Canoga Park, Calif.
THE OPEX SHIELD OPTIMIZATION CODE
R. L. Bernick 13 Jul. 1965 39 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-11516) CFSTI: HC $2.00/MF $0.50

The OPEX code uses the method of steepest descent to minimize laminated shield weight subject to the constraint of a constant dose rate at a detector point. The dose rate is approximated by an exponential fit to data obtained from experiments or analytical calculations. A Fortran listing of the code and a sample problem are included. Author (NSA)

N66-30470# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.
OPERATING INSTRUCTIONS FOR THE FORTRAN IV VERSION OF PROGRAM GAMMA-P (NMP 488)
C. S. Robertson and M. R. Edwards 23 Nov. 1965 20 p refs
(Contract AT(40-1)-2847)
(GEMP-392) CFSTI: HC $1.00/MF $0.50

Program GAMMA-P (production cross sections for gamma rays) was converted to the FORTRAN IV coding system. The changes in input and dimensions of variables required by this conversion are described. TAB

N66-30471# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MONTE CARLO METHOD—CODES FOR THE STUDY OF CRITICALITY PROBLEMS (ON IBM 7094) [METHODE DE MONTE CARLO—CODES POUR L'ETUDE DES PROBLEMES DE CRITICITE (IBM 7094)]

Jean Moreau, Hubert Rabot, and Claude Robin Oct. 1965 76 p (CEA-R-2872)

The two codes are presented which allow one to determine the multiplication constant of media containing fissionable materials under numerous and divided forms. They are based on the Monte-Carlo method. The first code applies to x, y, z, geometries. The volume to be studied should be divisible into parallelepipeds, the media within each parallelepiped being limited by non-secant surfaces. The second code is intended for r, θ, z geometries. The results include an analysis of collisions in each medium. Applications and examples with informations on time and accuracy are given. Author (NSA)

N66-30473# Brookhaven National Lab., Upton, N. Y.
A SMALL ANGLE SCATTERING EXPERIMENT
G. Rabinowitz Oct. 1965 17 p refs From Conf. on Programming for Flying Spot Devices, Columbia, N. Y., 27–29 Oct. 1965
(Contract AT(30-2)-GEN-16)
(BNL-9705; CONF-651039-2) CFSTI: HC $1.00/MF $0.50

Efforts toward the use of BNL pattern recognition programs to study p-p scattering in the angular range of 1 to 20 milliradians are discussed. The programs associated with this experiment divide into two stages: (1) the abstraction of beam track data from the pictures and (2) the analysis of the abstracted tracks. Only the first is discussed. NSA

N66-30491# Polish Academy of Sciences, Warsaw.
SOME REMARKS RELATIVE TO PROPERTIES OF THE DEKATRONS EZ10B IN THE FAST COMPUTER SYSTEMS [NIEKTORE UWAGI DOTYCZACE WLASCIWOSCI DEKATRONOW EZ10B W SZYBKICH URZADZENIACH LICZACYCH]
Ryszard Andrzejak and Stefan Wojtowicz 1966 15 p refs In POLISH; ENGLISH summary
(INR-686/III/E) CFSTI: HC $1.00/MF $0.50

Some remarks relative to properties of the dekatrons EZ10B adapted to the fast computer systems are given. Conclusions and experimental data obtained during elaboration of the fast counting problem with the above mentioned dekatrons are quoted. Author

N66-30515# Army Electronics Labs., Fort Monmouth, N. J.
EFFECT OF SIZE OF DATA PROCESSING CARDS ON MANUAL HANDLING
John S. Rakowski Apr. 1966 20 p ref
(ECOM-2686; AD-632076) CFSTI: HC $1.00/MF $0.50

Two experiments were made to determine the effect of ADP card size, thickness, ratio of height to width, and text position on handling ability. Performance times and errors for two groups of subjects were analyzed as were subjects' preferences. Results of analyses of variance showed that performance improved with small, thin cards of distinct rectangular shape. Text position had no effect on performance. Subjects generally preferred the card configurations which were most efficient. Author (TAB)

N66-30527*# Martin Co., Baltimore, Md.
A USER'S MANUAL FOR THE AUTOMATIC SYNTHESIS PROGRAM (PROGRAM C)
R. E. Klaman and T. S. Englar Washington, NASA, Jun. 1966 578 p
(Contract NAS2-1107)
(NASA-CR-475) CFSTI: HC $5.50/MF $2.75 CSCL 09B

The Automatic Synthesis Program (ASP) is a digital computer program, written in FAP, and it is reported that it is compatible with most IBM 7090-7094 installations. This manual describes the basic mechanics of ASP, discusses the subroutines available, and provides examples of computation and analysis. It is stated that numerical solutions of most problems in system theory which involve linear mathematics can be obtained using ASP and that it may be useful as an analytic design tool where extreme precision is not required. Time-varying linear systems are included and among the subroutines discussed in the text are: input–output calculations, the operations of matrix algebra, computation of the exponential of a matrix, and the solution of both discrete and continuous-time riccati equations. To illustrate the use of ASP and the steps required to solve various problems, this manual examines text book examples and some more involved practical problems. H.S.W.

N66-30548# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.
NUMERICAL ANALYSIS AND RELATED LITERATURE FOR SCIENTIFIC COMPUTER USERS, SECOND EDITION
James F. Price Mar. 1966 201 p refs *Its* Mathematical Note No. 456
(D1-82-0517; AD-632244) CFSTI: HC $5.00/MF $1.25

The second edition of this annotated bibliography lists the contents of over 150 books in English on numerical analysis and related literature. It is meant for the general scientific computer user and not for the research numerical analyst; the descriptions and suggestions are given with this in mind. It is expected that the most useful section will be the 27-page index which tells in which books various topics may be found. There is also a section describing how to look up further information on such topics which may be found in the literature. Author (TAB)

N66-30561# Mitre Corp., Bedford, Mass.
A COMPUTERIZED TECHNIQUE TO EXPRESS UNCERTAINTY IN ADVANCED SYSTEM COST ESTIMATES
S. A. Sobel Nov. 1965 121 p refs
(Contract AF 19(628)-2390)
(TM-03728; ESD-TR-65-79; AD-624894) CFSTI: HC $4.00/MF $0.75

The technique described presents a method to express uncertainty quantitatively in advanced system cost estimates. In particular, the technique suggests the employment of subjective probability distributions, which describe the uncertainty in each system element, to determine an approximate distribution for total system cost. A 7090 program was written to perform the computational operations. Author (TAB)

N66-30571# California Univ., Livermore. Lawrence Radiation Lab.
YOGI-N NEUTRON MONTE CARLO PROGRAM (CDC 3600 VERSION)
Richard J. Doyas 29 Jul. 1965 15 p refs
(Contract W-7405-ENG-48)
(UCRL-7630, Suppl-1) CFSTI: HC $1.00/MF $0.50

The YOGI-N program, an LRL neutron Monte Carlo code originally written in FORTRAN II language for the IBM 7090/7094 computer, is modified to a form appropriate for compilation on the CDC 3600/6600 system. The modifications incorporated, and the new input format, are described. The associated code TAPEMAKER, which prepares a cross-section tape for the YOGI-N program, is also translated. Author (NSA)

N66-30678# Bolt, Beranek, and Newman, Inc., Cambridge, Mass.

THE BBN-LISP SYSTEM Scientific Report No. 1

Daniel G. Bobrow, D. Lucille Darley, Daniel L. Murphy, Cynthia Solomon, and Warren Teitelman Feb. 1966 85 p

(Contract AF 19(628)-5065; ARPA Order 627)

(AFCRL-66-180; AD-632669) CFSTI: HC $3.00/MF $0.75

The report describes in detail the BBN-LISP system. This LISP system has a number of unique features; most notably, it has a small core memory, and utilizes a drum for storage of list structure. The paging techniques described allow utilization of this large, but slow, drum memory with a surprisingly small time penalty. These techniques are applicable to the design of efficient list processing systems embedded in time-sharing systems using paging for memory allocation. Author (TAB)

N66-30812# Atomics International, Canoga Park, Calif.

SCAP, IN IBM CODE FOR THE SPECTRAL ANALYSIS OF PULSED-NEUTRON DECAY DATA

J. A. De Juren, R. K. Paschall, and E. U. Vaughan 5 Mar. 1965 38 p refs

(Contract (AT(11-1)-GEN-8)

(NAA-SR-MEMO-10941) CFSTI: HC $2.00/MF $0.50

An IBM 7094 Fortran II code was written to perform the calculations for the spectral correction analysis of pulsed-neutron decay data. The theory of this new approach and the mechanics of using the code are described. The parameters $v\Sigma_a$, D_o and γ (heat transfer coefficient between moderator and neutron spectrum) are obtained as well as their errors. Also the variation in velocity as a function of buckling is calculated. Author (NSA)

N66-30813# Japan Atomic Energy Research Inst., Tokyo.

EXPANDA, THE ONE-DIMENSIONAL DIFFUSION EQUATION CODE FOR FAST REACTORS

Satoru Katsuragi and Tomoo Suzuki Apr. 1965 10 p refs In JAPANESE; ENGLISH summary

(JAERI-1091)

The code EXPANDA was developed from the code WANDA-6. EXPANDA can treat the criticality calculation of fast reactors by many group 1-dimensional diffusion model. The maximum number of groups is assumed 20. The inelastic scattering of neutrons was not included in the code WANDA. However EXPANDA can treat the inelastic scattering. The maximum number of mesh points and regions are 101 and 10 respectively. The criticality search is done by searching the critical thickness of some of multiplicative regions. When one intends to do parametric survey, it is very tedious to prepare a large number of input data. The code PREPANDA was prepared. The code can prepare the required data for EXPANDA automatically. The code LTFR was prepared in order to make the library tape used with PREPANDA. These three codes are described. Author (NSA)

N66-30815# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.

MOCA 2A—A FAST EFFECT MONTE CARLO CODE FOR THE IBM 7090

Henry C. Honeck (Brookhaven Natl. Lab.) and Robert A. Dannels [1965] 125 p refs

(WCAP-2685)

MOCA 2A is a Monte Carlo digital computer code which, by simulating the actual behavior of neutrons, statistically determines most of the quantities of interest to the reactor physicist and analyst. Designed primarily for the fast energy range, the code obtains results (such as fast fission, absorption, flux, age, slowing down distribution, etc.) for a heterogeneous lattice. A detailed explanation of what quantities may be calculated, exactly how they are determined and their physical interpretation is given as well as instructions for using the code. Author (NSA)

N66-30825*# Nuclear Utility Services, Inc., Washington, D. C.

PROJECT CUBED—A CODE TO UNFOLD BREMSSTRAHLUNG EXPERIMENTAL DISTRIBUTIONS First Quarterly Report, 13 Jan.-13 Apr. 1966

Julian J. Steyn [1966] 29 p refs

(Contract NAS5-10133)

(NASA-CR-76291) CFSTI: HC $2.00/MF $0.50 CSCL 09B

This report discusses the initial development of a Fortran IV IBM 7094 digital computer code to unfold bremsstrahlung photon distributions recorded by a sodium iodide scintillation spectrometer. The code—CUBED—is described in some detail. A system response matrix is generated from the characteristic spectra of standard radioisotope sources and applied to compute the incident photon number distribution by the Scofield iterative unfolding technique. The code executes ancillary analysis such as determination of energy differential spectra, energy integrated number, energy and dose data. The code description is preceded by a short theoretical background discussion. CUBED makes use of certain existing codes; these are delineated. Author

N66-30826# Atomics International, Canoga Park, Calif.

HISTORY ANALYSIS PROGRAM FOR FSM-4, FS-3, AND FLAP-4

R. J. Mikell and G. T. Chang Sep. 1965 53 p

(Contract AT(11-1)-GEN-8)

(NAA-SR-MEMO-10913) CFSTI: HC $3.00/MF $0.50

The History Analysis Program, developed for the analysis of data recorded on magnetic tape by the SNAP daily programs which process data acquired from the three systems FSM-4, FS-3, and FLAP-4 on a daily basis, is described. NSA

N66-30831# Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany). Zentralinstitut fuer Kernforschung.

NEW RANDOM NUMBER GENERATOR FOR THE ZRA-1 [NEUE ZUFALLSZAHLENGENERATOREN FUER DEN ZRA-1]

Horst Boettger Dec. 1964 34 p refs In GERMAN

(ZFK-TPH-14)

In addition to the specification of the most important properties of equally distributed random number generators and the possibilities of their representation on digital computers, the peculiarities of the ZRA-1 were taken into consideration. It was shown on the basis of examples that not every random algorithm is usable for the ZRA-1. A detailed

description of a new method of random number production on the ZRA-1 and its characteristics, advantages, and applications is given. Two representations from a group of generators are given as ZRA-1 code. After a brief summary of the most important test methods for random numbers, a description of the tests carried out for the generators is reported. The most important test results are tabulated. Author (NSA)

N66-30832# Oak Ridge National Lab., Tenn. Radiation Ecology Section.

REGRESS—A MULTIPLE REGRESSION AND CORRELATION PROGRAM WITH GRAPHIC OUTPUT FOR MODEL EVALUATION

George M. Van Dyne Dec. 1965 54 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1288) CFSTI: HC $3.00/MF $0.50

This general multiple regression and correlation program was written with the intent of being simple and yet flexible. The program will handle up to 60 variables and will give summary statistics on the input variables as well as correlation and regression analyses. Deviations from the model are calculated and a variety of Calcomp plots are available. Options within the program allow reading data from cards or tape, variable format or standard format, names generated or names read in, weighted regression or nonweighted regression, a variety of transgenerations, regression through the origin or not through the origin, plots of each variable against deviations from the model and/or plots of each independent variable against each other independent variable and/or plots of each independent variable against the dependent variable, or plots of the dependent variable with each independent variable with the dependent variable corrected for differences of all other independent variables from their means. The program is written in Fortran 63 and is available as a main program, Regress 1, or as a subroutine Regress 2. Author (NSA)

N66-30838# Atomics International, Canoga Park, Calif.

LEAST SQUARE DETERMINATION OF THE DIFFUSION COEFFICIENTS OF GASES IN SPHERICAL SOLIDS

W. A. Young 8 Jul. 1965 81 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-MEMO-10741) CFSTI: HC $3.00/MF $0.75

A general least square method is presented for the treatment of data to give the best fit to any well behaved function. The method is specifically applied to the determination of the diffusion coefficient of a gas in a homogeneous spherical solid. A FORTRAN IV computer program for use with IBM-7090/7094 is described which effects this determination and graphically displays the calculated sorption curve by means of SC-4020 automatic display equipment. A second program is also described which yields a graphic display of sorption curves for given diffusion coefficients. Author (NSA)

N66-30841# Oak Ridge National Lab., Tenn. Instrumentation and Controls Div.

THE EFFECTS OF TIME DELAY SIMULATION METHODS UPON THE STABILITY AND TIME RESPONSE OF SIMULATED SYSTEMS

Wister Cordell Wright (Thesis—Tennessee Univ.) Dec. 1965 147 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1323) CFSTI: HC $4.00/MF $1.00

Problems involved in the analog-computer simulation of time delays are studied, including those simulations utilizing conventional mathematical approximations and computer components, and those utilizing the capacitor wheel (an electromechanical delay simulator). A theoretical and experimental study of the phase and magnitude errors induced by these simulations on the stability of simulated closed-loop systems is presented. NSA

N66-30894# California Univ., Livermore. Lawrence Radiation Lab.

EXPALS—FORTRAN CODE FOR EXPONENTIAL APPROXIMATION BY LEAST SQUARES

C. Douglas Gardner 2 Dec. 1965 8 p refs
(Contract W-7405-ENG-48)
(UCRL-14541) CFSTI: HC $1.00/MF $0.50

EXPALS is a weighted least-squares exponential FORTRAN code to be run under the MONITOR system of the BIM 7030 (Stretch) computer. This routine fits a linear combination of real exponential decay functions by the Prony–Householder iteration method. Author (NSA)

N66-30920# Atomic Energy of Canada, Ltd., Chalk River (Ontario).

SUBROUTINES FOR DIGITAL SIMULATIONS

J. D. Kendall Dec. 1965 44 p
(AECL-2530) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.50

The G-20, APEX-IV subroutines DYNA, GRAPH, BOWAT, TEMP, VSF, VSG, HF, HG, SF, SG, DVSFDP, DVSGDP, DHFDP, DHGDP, PRES and INTERP are described. These are for use in preparing digital simulations of dynamic systems, in particular, thermodynamic systems. DYNA performs the input and output and integration functions. Data cards are used to set up output formats and integration data. The programmer must prepare little more than the mathematical model and a set of data cards. GRAPH outputs data in a graphical form. BOWAT is similar to DYNA except provision is made to input thermodynamic tables. The other subroutines compute the thermodynamic properties from these tables. Author (NSA)

N66-30988# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.

COMPUTER PROGRAMS USED FOR DESIGN CALCULATIONS ON THE HARWELL VARIABLE ENERGY CYCLOTRON

A. R. Mayhook Nov. 1965 56 p refs
(RHEL/R-113)

A system of computer programs was written for doing calculations involved in the design and operation of the Harwell Variable Energy Cyclotron. The programs process field measurements from the magnetic field survey and use the results to predict the magnetic fields in the cyclotron and to compute particle trajectories in these fields. A description of the programs, including underlying theory and a brief outline of the structure of each routine, and also all information required to run the programs are included. Author (NSA)

N66-30988# Sandia Corp., Albuquerque, N. Mex.

DIGITAL COMPUTER SIMULATION AS AN EXPERIMENTAL TOOL IN THE EVALUATION OF SAMPLED-DATA SYSTEMS

R. D. Andreas Nov. 1965 21 p refs
(Contract AT(29-1)-789)
(SC-DR-65-318) CFSTI: HC $1.00/MF $0.50

The probelm for determining the accuracy of an instrumentation system which acquires a periodically sampled representation of an analog time function is an important but difficult step in the evaluation of alternative systems during system design. The basic aspects of the problem are described, a lack of available theoretical tools to attack the problem is pointed out, and thus digital computer simulation is offered as an experimental tool. Author (NSA)

N66-30990# Sandia Corp., Albuquerque, N. Mex.
A DIGITAL COMPUTER PROGRAM FOR THE SIMULATION OF SAMPLED DATA SYSTEMS
G. D. Phaklides Sep. 1965 41 p refs
(Contract AT(29-1)-789)
(SC-DR-65-312) CFSTI: HC $2.00/MF $0.50

The Sampled Data Simulator is a program written for the Control Data Corporation 3600 computer. The program simulates a fixed-frequency sampling and reconstruction system. Program options, system specifications, and a digitized input waveform were supplied by the user. Simulation results are presented in both printed and plotted forms. No computer experience is required to use the program. Author (NSA)

N66-31003# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
PSEUDO—A CODE FOR THE CONSTRUCTION OF STATISTICAL RESONANCES IN THE UNRESOLVED RESONANCE REGION
M. W. Dyos 18 Jan. 1966 6 p refs
(Contract AT(04-3)-167)
(GAMD-6908) CFSTI: HC $1.00/MF $0.50

The PSEUDO code was written to sample randomly from the distribution functions for the statistical distribution of neutron widths and level spacings. The code has the flexibility to give some statistical information on the nature of the ladder (or ladders) of resonances generated. The code is written in FORTRAN IV. NSA

N66-31014# Princeton–Pennsylvania Accelerator, Princeton, N. J.
CURRENT STATUS OF THE PRINCETON PATTERN RECOGNITION PROGRAM
M. J. Bazin and J. W. Benoit 29 Oct. 1965 21 p refs Presented at the Columbia Univ. Conf. on Programming for Flying Spot Digitizers, New York, Oct. 1965
(Contract AT(30-1)-2137; Grant NSF GP-579)
(PPAD-858E; CONF-651044-12) CFSTI: HC $1.00/MF $0.50

The general philosophy of the pattern recognition program at Princeton is discussed. A brief outline of specific methods used and some results obtained is presented. NSA

N66-31058# California Univ., Livermore. Lawrence Radiation Lab.
STATISTICS AND COMPUTERS IN MINEROLOGY, MATERIALS RESEARCH AND SEDIMENTARY PETROGRAPHY
J. S. Kahn 10 Mar. 1966 17 p refs Presented at the 6th Ann. Symp. on Computers and Operations Res. in Mineral Ind., University Park, Pa., 17–23 Apr. 1966
(Contract W-7405-ENG-48)
(UCRL-14759; CONF-660410-1) CFSTI: HC $1.00/MF $0.50

The resolution of three different problems, in which the computer and statistics played a significant role as tools is discussed. The first two problems are concerned with obtaining estimates of regression coefficients. In the first study, which is a straightforward application of the estimation of linear parameters by the method of least squares, these estimates were used to generate a prediction curve for the strength of polycrystalline BeO. The second problem relates the indexes of refraction of single crystals of synthetic BeO to the different wavelengths at which the indices were measured. This is done by fitting the experimental data to a Sellmeier equation. Here least-squares estimation is performed with nonlinear parameters. Finally, the last problem is concerned with the analysis of dimensional or crystallographic orientation data. Here standard procedures of statistical estimation and hypothesis testing are used with the computer acting mostly as a modest decision maker and information storer. Author (NSA)

N66-31218*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE AMTRAN SAMPLER SYSTEM INSTRUCTION MANUAL
M. R. Albert, P. C. Clem (Northrop Corp., Huntsville, Ala.), L. A. Flenker, J. Reinfelds, R. N. Seitz et al Jul. 1966 144 p refs Revised
(NASA-TM-X-53342) CFSTI: HC $4.00/MF $1.00 CSCL 09B

Complete instructions are given for the efficient utilization of the AMTRAN sampler software. AMTRAN (for Automatic Mathematical Translator) is an on-line remote terminal computer system. It permits the scientist and engineer to enter mathematical equations into the computer in their natural textbook format and to obtain immediate graphical displays of results. In addition, the professional programmer is provided with the capability to build high level operators which are indistinguishable from the basic intrinsic instruction set. The sampler version of AMTRAN retains most of the software features of AMTRAN, but requires no hardware modification and can be used on any IBM 1620 computer with at least 40K storage. Author

N66-31247# System Development Corp., Santa Monica, Calif.
STATISTICAL APPROACH FOR VALIDATING SIMULATION MODELS BY COMPARISON WITH OPERATIONAL SYSTEMS—ILLUSTRATED FOR TRAFFIC FLOW
A. V. Gafarian and John E. Walsh 24 Feb. 1966 20 p ref
(SP-2367; AD-632478) CFSTI: HC $1.00/MF $0.50

Development of computerized simulations including random elements is sometimes desired for types of systems that are operational for special cases. Then, the suitability of a prospective simulation model can be checked for these special cases. That is, some of the important kinds of properties for these systems can be compared for agreement. The simulation model is unsatisfactory when there is too much disagreement. The first step is to decide on the properties to be compared. Suitable standardization is important for obtaining comparisons that are both feasible and valid. The next step is to quantitatively determine how decisions on comparisons would be made if the properties considered, or their representative values (for example, expected values), were exactly determined. Finally, statistical methods are developed for making these comparisons on the basis of observed values for these properties. When the simulation is of a random nature but the cost of a run is relatively small, expected values of the properties can be almost exactly determined for the simulation model.

This is accomplished by repeating simulations a very large number of times. Nonparametric methods, including asymptotic considerations, furnish the basis for the statistical methods. An example pertaining to traffic flow is used to illustrate the overall approach. Author (TAB)

N66-31248# System Development Corp., Santa Monica, Calif.
SDC RESEARCH AND TECHNOLOGY DIVISION EXTERNAL PUBLICATIONS, 1961–1965
C. Baum and L. D. Wilhelm 1 Mar. 1966 24 p refs
(TM-698/065/00; AD-632481) CFSTI: HC $1.00/MF $0.50

The document presents a complete listing of external publications by SDC's research and technology division staff members and consultants. The present issue lists journal publications, papers in conference proceedings, books, and book chapters for the years 1961–1965 inclusive, grouped in general according to subject matter. Author (TAB)

N66-31272# System Development Corp., Santa Monica, Calif.
TRENDS IN COMPUTER HARDWARE
Charles Fanwick 17 Mar. 1966 35 p
(SP-2393; AD-632477) CFSTI: HC $2.00/MF $0.50

The capabilities of elements of data processing systems which might be expected to be economically available about 1971 are described. This description is based on an extrapolation by the writer of the present state-of-the-art. Systems are hypothesized containing these capabilities in their parts. It is shown that these systems have capabilities inherent in the hardware which are now expected to be provided only by sophisticated software developments. It is emphasized that software system designers should anticipate hardware capabilities which will be available at the time when their software systems are expected to be available. Author (TAB)

N66-31275# Dartmouth Coll., Hanover, N. H.
NOTES ON THE MULTIDIMENSIONAL SCALING OF ELASTIC DISTANCES
Victor E. McGee Jan. 1966 46 p
(Grant Nonr-3897-05)
(AD-629278) CFSTI: HC $2.00/MF $0.75

The basic problem of determining the stimulus coordinates in a minimum dimensional space in considered in relation to multidimensional scaling. Previously evolved methods are reviewed including (1) a two-stage procedure in which a multidimensional form of successive interval scaling plus an additive constant converted the proximities into distances; (2) a one-stage approach in which the proximities were monotonically related to the finally accepted distances, with the nature of this distance function decided by the iterative procedure; and (3) a mathematical approach in which an algorithm was used and with each iteration provided a best-fitting monotonic transformation of the proximities to match the distances in use at that iteration. The elastic approach is described. This is based on the concept that a configuration of points is joined together by means of elastic springs; to allow tolerance for judgment variability, the spring is allowed to be squashed or stretched (distorted) into various other lengths. Formulas for the chi-square criterion are given. The Fortran program is discussed, the procedure is listed, and a fully worked example is included. M.G.J.

N66-31281# Oregon State Univ., Corvallis. Computer Center.
NEBULA COMPUTER Progress Report, 1 Jun. 1965–1 Jan. 1966
W. A. Nickodemus, ed. 14 Jan. 1966 84 p
(Contract Nonr-1286(11))
(CC-66-1; AD-633364) CFSTI: HC $3.00/MF $0.75

A medium speed, serial digital computer was constructed using glass delay lines circulating at 22 mc as memory. An arrangement of information within the 22 mc memory allows a simple interface with the 340 kc arithmetic unit, which results in an effective zero latency time and provides possibilities for an associative memory. The arithmetic unit has a command structure similar to large parallel machines and uses flip-flop arithmetic and control registers throughout. All hardware development has been aimed toward the concept of easy modification, elaborate console controls for effective man–machine interaction, and low cost. Author (TAB)

N66-31368*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
IMPLEMENTATION INVESTIGATIONS OF ZVA/FVA COMPRESSION ALGORITHMS Summary Report, 1 Jul. 1965–28 Feb. 1966
H. N. Massey and W. E. Smith 28 Feb. 1966 156 p refs
(Contract NAS8-5110)
(NASA-CR-76389; LMSC-669224) CFSTI: HC $5.00/MF $1.00
CSCL 09B

Design techniques for implementing specific compression algorithms were investigated, and a breadboard test program was conducted to evaluate the concepts. The basic rules for the zero order, variable corridor, artificial preceding sample transmitted (ZVA) algorithm are listed, along with the rules for the first order, variable corridor, artificial preceding sample transmitted (FVA) algorithm. The ZVA/FVA hybrid data compressor is described, and it is pointed out that the breadboard consists only of the high speed logic section and a small portion of the low speed logic section. The breadboard has a single channel capability to accept parallel inputs from an input signal simulator, perform either an FVA or ZVA algorithm implementation, and provide parallel outputs to a buffer memory. Buffer memory and reference requirements are given, and methods for implementing a reference memory with a storage capacity were investigated. The signal simulator and output monitoring equipment are described; schematics amplify the text. Overall test results indicate that the breadboard successfully performed both the FVA and ZVA algorithms over high and low temperature extremes. M.G.J.

N66-31376*# National Bureau of Standards, Washington, D. C.
THE NBS CORD TIME SHARING SYSTEM
Thomas N. Pyke, Jr. 1 Apr. 1966 26 p
(NASA Order R-09-022-039)
(NASA-CR-76398; NBS-9339) CFSTI: HC $2.00/MF $0.50
CSCL 09B

Described is a CORD (Computer with On-line Remote Devices) operating system consisting of an executive program designed to enable the dual-processor computer facility with multiple remote terminals to operate in a time-shared mode. It is pointed out that programs and data can be entered into the system at each remote terminal, including teletypes and display subsystems, the program execution initiated, and results returned to the terminals. This reference manual contains information for users of the CORD system from a teletype terminal. A method for entering system commands, and a description of the program run in the time-shared mode is

included, as are user program operation codes and command vectors. Error returns and error numbers accompanied by a listing of internal character representations are summarized. R.Li.

N66-31377*# National Bureau of Standards, Washington, D. C.
MO BIDIC—TELETYPE INTERFACE
Orrington R. Hall Apr. 1966 37 p
(NASA Order R-09-022-039)
(NASA-CR-76399; NBS-9338) CFSTI: HC $2.00/MF $0.50
CSCL 09B

A detailed engineering report is presented on a device designed to furnish a logic and electrical interface between the Mobidic B twin digital computer and a standard eight-level code teletypewriter. Among its features are a facility for handling a full ASCII (American Standard Code for Information Interchange) character and a means of checking the character most recently transmitted to the teletype. This latter feature, the echo check, may be implemented in either a full-duplex or half-duplex system. In either mode of operation, random manual depression of a teletype key while that teletype is receiving information will result in a disparity between the character transmitted and the character remaining in the interface at the end of transmission. Upon detection of such a disparity, an appropriate response may be obtained from the system. This feature affords the operator at the remote teletype the ability to communicate with the system during a long system-to-remote-station-transmission and thus has considerable utility. Author

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N66-29987# Army Electronics Labs., Fort Monmouth, N. J.
RECENT DEVELOPMENTS IN SOLID-STATE MICROWAVE DEVICES
Wesley G. Matthei Mar. 1966 42 p refs
(ECOM-2676; AD-632083) CFSTI: HC $2.00/MF $0.50

The purpose of this report is to review some of the outstanding accomplishments in the field of solid-state microwave devices which have occurred during the past 18 months. The latest improvements in parametric amplifiers and transistor amplifiers are noted. The area of microwave solid-state oscillators is discussed in detail by dividing it into three parts; transistor oscillators and multipliers, avalanche transit time (Read) diodes, and Gunn oscillators. Curves are presented which indicate the current state of the art of transistor sources. The mechanisms of the avalanche transit time diode and the Gunn oscillator are described in a qualitative manner. A brief discussion is given about the new circuit and device packaging techniques and Schottky-Barrier mixer diodes which are being developed to improve microwave receivers. A few examples of microwave modules, using hybrid techniques are given, and some examples of microwave integrated circuits are noted. It is concluded that the solid-state microwave field is in a stage of rapid growth and changing technology, and that this expansion will continue in its rapid pace, due to the development of improved transistors, bulk-effect devices, hybrid and integrated circuit modules. Author (TAB)

N66-29997# Research Triangle Inst., Durham, N. C.
INTEGRATED SILICON DEVICE TECHNOLOGY. VOLUME XI: BIPOLAR TRANSISTORS Technical Report, Mar.-Oct. 1965
J. R. Hauser Apr. 1966 359 p refs
(Contract AF 33(615)-1998)
(ASD-TDR-63-316, Vol. XI; AD-632556) CFSTI: HC $7.00/MF $1.75

Both bipolar transistor theory and the characteristics and design of transistors in integrated circuits are discussed. The discussion of transistor theory includes not only the conventional transistor models of uniformly doped emitter, base, and collector regions and of constant electric field in the base (exponential impurity doping in the base) but also includes models for general impurity profiles in the emitter, base, and collector regions. Both small signal models and large signal models are discussed. High current phenomena are considered. Effects which are important at low currents are also discussed. These are generation-recombination effects in junction depletion regions and phenomena associated with surface space charge layers. Numerical examples are presented throughout the volume to illustrate the various models developed and discussed. With the exception of grounded emitter current gain, transistor parameters can be fairly well correlated with theory. In addition to general transistor theory, the characteristics and design of transistors in integrated circuits are discussed. This includes a discussion of typical transistor structures, isolation problems, topological design, multiple transistor structures, and the differences between discrete and integrated transistors. Design examples are included to illustrate the factors discussed for a small number of typical uses of transistors in integrated circuits. Author (TAB)

N66-30011# Navy Electronics Lab., San Diego, Calif.
THIN-FILM METAL-BASE TRIODES Research Report, May-Nov. 1965
B. D. Evans 15 Feb. 1966 46 p refs
(NEL-1356; AD-631875) CFSTI: HC $2.00/MF $0.50

An experimental and theoretical study of an aluminum–aluminum oxide–aluminum triode showed it to have active-device characteristics equivalent to those of two diodes back-to-back. The phenomena involved can be explained in terms of tunnel emission. The report includes a survey of the literature, and proposals for investigation of other thin-film metal-base triodes of various structures and compositions. Author (TAB)

N66-30021# Naval Fleet Missile Systems, Corona, Calif. Analysis and Evaluation Group.
MEASUREMENT OF MICROWAVE DELAY LINE LENGTH
J. J. Hoote 3 Jan. 1966 24 p
(NAVWEPS-9079; AD-632246) CFSTI: HC $1.00/MF $0.50

Two techniques for electrically measuring microwave waveguide delay lines are presented in this report. These two methods, depending on reflection and phase cancellation phenomena, permit accurate determination of delay line length with equipment commonly found in the microwave laboratory. A table has been included for X-band waveguide which minimizes the arithmetic required in utilizing the methods. Author (TAB)

N66-30038# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEASURING CONVERTERS OF ELECTRIC MAGNITUDES TO PULSE FREQUENCY

Yu. N. Yevlanov and R. R. Kharchenko 30 Mar. 1966 22 p refs Transl. into ENGLISH from Elektrichestvo (Moscow), no. 1, 1965 p 48–53
(FTD-TT-65-908/1+2+4; TT-66-61188; AD-632069) CFSTI: HC $1.00/MF $0.50

A survey was made of the principles of constructing linear measuring converters of electric magnitudes to pulse frequency. TAB

N66-30039# Hughes Aircraft Co., Fullerton, Calif.
MICROMINIATURIZATION MULTIPLANE INTERCONNECTIONS Progress Report, 1 Oct.–31 Dec. 1965
W. T. Rhoades Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 81 p refs /ts Rept.-2
(Contract DA-28-043-AMC-01439(E))
(ECOM-01439-2; AD-632335) CFSTI: HC $3.00/MF $0.75

The purpose of this work is the development of interconnections for ultra-high-speed micro-circuit module arrays. The MCM passive crosstalk analysis and measurements are presented. From these results, the MCM must use matched lines with characteristic impedances below 400 ohms if crosstalk is to be below 10% over the frequencies of interest. Progress on the subassembly and assembly designs is described. Various delay measurements on the ultra-high-speed gate, show that the system delay will be below 5 nanoseconds, if less than ±15% change in line impedance is maintained. Thermal resistance from circuit to case has been analyzed, and with the present chip size (40×40 mils) it will be below 13°C/W. Author (TAB)

N66-30221# Commissariat a l'Energie Atomique, Saclay (France).
PROCESS FOR THE FABRICATION OF AN ELECTRIC DISCHARGE TUBE IN A GAS CONTAINING A CERTAIN QUANTITY OF TRITIUM AND AN ELECTRIC DISCHARGE TUBE IN A GAS OBTAINED ACCORDING TO THIS PROCESS [PROCEDE POUR LA FABRICATION D'UN TUBE ELECTRIQUE A DECHARGE DANS UN GAZ CONTENANT UNE CERTAINE QUANTITE DE TRITIUM ET TUBE ELECTRIQUE A DECHARGE DANS UN GAZ OBTENU SELON CE PROCEDE]
S. A. Philips 7 Sep. 1965 11 p Transl. into FRENCH from Dutch patent no. 97478
(CEA-TR-X-356)

A procedure for the fabrication of a discharge electric tube in a gas containing some tritium, adsorbed by a thin layer of titanium, zirconium, or a similar hydrogen absorber, is described. The titanium, zirconium, or analogous metal is deposited as a very finely divided powder in a tube by pulverization in an electric discharge in a rare gas or by vaporization. The tritium is then emitted in contact with the powder in such a quantity that the metallic powder is only incompletely saturated. The most external layers of the grains are inactivated to such a measure that heating at the temperature created by pumping at a long time does not release the tritium. The metallic powder is then placed in suspension and a measured quantity of this suspension is applied to the site in the discharge tube. The customary procedure for tube fabrication is then followed. NSA

N66-30251# Sperry Rand Research Center, Sudbury, Mass.
HIGH-GAIN LOW-NOISE PHOTODETECTORS Scientific Report, 1 Apr. 1965–31 Mar. 1966
H. Kroger Apr. 1966 117 p refs
(Contract N600(19)-63823)
(SRRC-CR-66-13; AD-632441) CFSTI: HC $4.00/MF $0.75

The object was the development and evaluation of wide band p-n junction photodetectors which have the capability of internal modes of amplification. Photodiodes which make use of avalanche multiplication have been fabricated and their behavior studied in detail. The avalanche photodiode compares favorably with the photoparametric diode with regard to both net amplification and attainable signal-to-noise ratio for many applications. Avalanche gain of 45 dB has been observed for modulation frequencies near 1 ghz in silicon photodiodes. The avalanche photodiodes are shot-noise-limited detectors, even for modest values of multiplication ($M^2 \approx 5$–20). The shot-noise available power of the avalanche photodiodes varied approximately as M^2. The reasons for this dependence are not completely clear; they could involve both space-charge-induced 'smoothing' of avalanche noise as well as the fact that the ionization coefficients of holes and electrons are quite different (by an order of magnitude) in silicon. Author (TAB)

N66-30261# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
TORUS-TYPE MULTIPLYING SYSTEM OF A PHOTOELECTRIC MULTIPLIER
A. G. Berkovskiy 28 Apr. 1965 5 p Transl. into ENGLISH from Russian Patent no. 161087 (Appl. no. 827478/26-9, 27 Mar. 1963) 2 p
(FTD-TT-64-1293/1+2; AD-615252) CFSTI: HC $1.00/MF $0.50

The object of the invention is a torus-type multiplying system of a photoelectric multiplier which is distinguished by the fact that for the purpose of improving the rigidity, raising the quality of the centering of the emitters, and simplifying the technology of the assembling, the inner emitters are fastened on ring screens arranged between ring screens on which there are fastened the outer emitters, and the relative disposition of the screens is fixed by insulating rods. Author (TAB)

N66-30354*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SPECTRAL DEGRADATION OF FREQUENCY SYNTHESIZERS
E. H. Johnson and T. E. McGunigal Apr. 1966 28 p
(NASA-TM-X-55531; X-523-66-197) CFSTI: HC $2.00/MF $0.50 CSCL 09C

An evaluation of three commercially available frequency synthesizers was conducted to determine the amount of degradation that can be expected, when the synthesis technique is employed to obtain a desired frequency. Data were obtained and recorded of the RF spectrum and the phase fluctuation spectral densities of each of these synthesizers. In addition, each synthesizer was compared with a hydrogen maser to determine the aging rate of the crystal standard in the synthesizer. The differences between the synthesizers is discussed, and it is stated that the data included in this report will allow determinations to be made of which synthesizer is best suited for a given application, and the spectral characteristics which may be expected. H.S.W.

N66-30364*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
POWER SWITCHING IN DIGITAL SYSTEMS
Rodger A. Cliff Washington, NASA, Jul. 1966 12 p ref
(NASA-TN-D-3477) CFSTI: HC $1.00/MF $0.50 CSCL 09C

In many applications, particularly spacecraft, it is important to minimize power consumption. Turning off the power to parts of a digital system when they are not in use reduces overall power drain. Also, data transfer between sections of a digital system can be accomplished without gates by appropriate switching of power supply voltages. This reduces power drain and complexity by eliminating the need for many gate functions. With power switching, integrated circuits can be used in applications which would otherwise require discrete component circuits because of power constraints. The optical aspect computer of the Anchored Interplanetary Monitoring Platform spacecraft is an example of the saving that power switching can produce; power drain is reduced from 1.3 watts to 0.3 watts. This computer would have been impractical without the use of power switching. Author

N66-30404*# National Engineering Science Co., Pasadena, Calif.
DETERMINATION OF RADIATION PATTERNS FOR A CIRCULAR WAVEGUIDE SLOT ARRAY
C. M. Knop *In its* Res. Study of Some RAM Antennas Jun. 1965 61 p refs (See N66-30401 17-09) CFSTI: HC $7.41/MF $2.25

Results are presented from a study of the far field patterns in the equatorial plane of a dielectric coated resonant shunt slot waveguide array, to determine whether there exists an optimum thickness of dielectric coating such that these radiation patterns can be made to approach an omnidirectional pattern. The computations made during the investigation are discussed, and it was concluded that a 54 element X-band array of uniformly excited, in phase, circumferential slots centered in the same plane and flush with the metallic surface, should produce onmidirectional coverage in the equatorial plane even if the array is coated with a dielectric material of dielectric constant near 2.5, and is of any thickness from zero to three quarters of an inch. H.S.W.

N66-30517# New York Univ., N. Y. Research Div.
MICROWAVE MEASUREMENTS OF ADMITTANCE, IMPEDANCE AND TRANSFER FUNCTION PARAMETERS
Jack Lustig Mar. 1965 86 p
(Contract NObsr-89288; Proj. Sete)
(SETE-210/84; AD-624228) CFSTI: HC $3.00/MF $0.75

The purpose of this report was to present in a summary manner the measurement of microwave impedance, admittance and transfer function characteristics. The manufacture of these systems on a commercial basis, at present, is limited to a handful of companies. Therefore, in order to make the report more meaningful the format was broadened to include theory, published articles, prototype developments and patent information. TAB

N66-30524# General Electric Co., Syracuse, N. Y. Electronics Lab.
X-BAND TUNNEL DIODES FOR PHASED ARRAY RADAR Quarterly Progress Report, Dec. 14, 1965–Mar. 14, 1966
C. W. Lee, D. H. Kortkamp, and M. Chronis [1966] 40 p
(Contract NObsr-89328)
(QPR-3; AD-632005) CFSTI: HC $2.00/MF $0.50

A push-pull amplifier has been built using a pair of 1.8 ma germanium diodes. The amplifier has successfully demonstrated the improvement of the dynamic range by a factor 10 dB over a single diode amplifier. The amplifier has been operated at a gain of 11 to 13 dB with absolute stability and without degrading the noise figure. Use of the new lead design improves the ease of fabrication and testing of the tunnel diodes and reduces slightly the minimum inductance of the miniaturized pill package. Fabrication of 9 ma peak current tunnel diodes in the same package was begun. Pairs of both 1.8 ma and 9 ma peak current were fabricated into 3.6 ma and 18 ma peak current push-pull tunnel diode devices. Various modifications have been made in the inverse sandwich tunnel diode design. Author (TAB)

N66-30643# Hughes Aircraft Co., Newport Beach, Calif. Microelectronics Div.
EFFECT OF TRANSISTOR DESIGN PARAMETERS ON RADIATION RESPONSE (SURFACE EFFECTS) Final Report, 15 Dec. 1964–14 Dec. 1965
Brian D. Gallagher, Vicent R. Honnold, and Jerome J. Mazenko Apr. 1966 64 p refs *Its* Rept.-4
(Contract DA-28-043-AMC-00418(E))
(ECOM-00418(E)-F; AD-632716) CFSTI: HC $3.00/MF $0.75

During this program, the relationship between various transistor surface conditions and transient device leakage currents (ΔI_{cbo}) due to radiation exposure were studied. These studies were made by utilizing both 2N708 type transistors with various surface treatments, and similarly treated groups of N type silicon bars. The primary surfaces studies were (1) oxidized, (2) sandblasted, etched, and mechanically polished. Additionally, an analytical model describing the predominate mechanism of surface radiation affects was developed. This relationship was tested against the experimental data and order of magnitude agreement was found. The program has led to the following conclusions: (1) at a given value of surface recombination velocity, the radiation induced response, ΔI_{cbo}, in a device is less for smaller values of minority carrier lifetime. Thus, no device characteristic compromise is necessary to achieve maximum device radiation resistance. (2) A small increase in radiation resistance can be achieved in a device by increasing surface recombination velocity. However, the improvement in radiation resistance is obtained. Author (TAB)

N66-30709# Hamilton Standard Div., United Aircraft Corp., Broad Brook, Conn.
MICROBONDS FOR HYBRID MICROCIRCUITS Quarterly Progress Report No. 7, 1 Aug.–31 Oct. 1965
P. R. Amlinger and S. L. Sherman Apr. 1966 87 p refs
(Contract DA-36-039-AMC-03742(E))
(HSER-3135; ECOM-03742-7; AD-632928) CFSTI: HC $3.00/MF $0.75

Mechanical strengths of Type E (0.001 inch Au wire resistance welded to Au/Cr films on Vycor), Type G (0.001 inch Au wire resistance welded to Au/Cr films on glazed alumina), and type A'$_2$ (0.002 inch Au wire resistance welded to Au/Cr films on sapphire) microbonds were evaluated. The reliability goal of an expected failure of 3 bonds per 1000 at a 90% confidence level was not met, however, 95% of the failures can be attributed to poor film adhesion. Electrical resistance measurements on bond types E, F, G, H, A'$_1$ and A''$_1$ showed that all bond types met the contractual goal of SCL-7746A. After thermal shock, only the Type H bonds increased in resistance by more than 10%, the reliability goal. The pull strengths were somewhat lower (approximately 11% lower in the worst case) after thermal cycling. The initial weld schedule development for resistance welding of goldplated nickel riser wires to Ni/Au/Cr films on alumina (Type V microbonds) indicated that much stronger welds were obtained than with copper riser wires. The shear pull strength of the gold-plated nickel riser wire bonds was near the pull strength of the wire itself.
Author (TAB)

N66-30717# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.

THIN FILM TECHNIQUES FOR SILICON INTEGRATED CIRCUITS Quarterly Report, 1 Jun. 1964–31 Jul. 1965

C. D. Phillips and R. W. Wilson Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 95 p *Its* Rept.-4

(Contract DA-28-043-AMC-00097(E))

(ECOM-00097(E); AD-632931) CFSTI: HC $3.00/MF $0.75

This program is a continuation of the program initiated in 1963. Under the initial program the contractor studied the effects of thin film materials and processes used in the film technologies existing at that time. The compatibility of materials and processes with silicon integrated circuits was verified. Thin film resistive and capacitive elements were fabricated on silicon chips containing a 2N708-class silicon transistor; a detailed characterization of these samples was made. The required circuits were fabricated, characterized, and delivered to the USAEL. The performance objectives of the present program was to obtain compatible thin film capacitors and resistors. Author (TAB)

N66-30748*# ITT Industrial Labs., Fort Wayne, Ind.

RESEARCH IN THE DEVELOPMENT EFFORT OF AN IMPROVED MULTIPLIER PHOTOTUBE Sixth Quarterly Report

F. H. Barr and E. H. Eberhardt 30 Mar. 1966 22 p refs

(Contract NASw-1038)

(NASA-CR-76295; ITTIL-66-1018) CFSTI: HC $1.00/MF $0.50 CSCL 09A

The dark current and dark counting characteristics of a series of multiplier phototubes were investigated. The primary technique used was that of cooling the tube, particularly the photocathode, by means of a multiplier phototube refrigerated chamber. Details are given on the modification of this equipment which resulted in an overall noise reduction permitting the counting of pulses of about half the amplitude as before without counting pulses originating outside the tube. Different modes of multiplier operation were tried to determine their effect on multiplier noise, and the effect of multiplier phototube ground point on the noise content was considered. Multiplier phototubes with cascade aperture design for improving their electron response were also tested. From the data collected, it was concluded, for the tubes tested, that reasonable correlation is obtained between the photocathode dark current density and photocathode dark count density. Furthermore, the cathode dark current was not as temperature sensitive as expected based on the normal behavior of thermionic emission. L.E.W.

N66-30797*# Auburn Research Foundation, Inc., Ala.

EVALUATION OF PHASE DELAY IN A CRYSTAL MIXER Technical Report No. 2

H. M. Summer 16 Mar. 1964 43 p

(Contract NAS8-5231)

(NASA-CR-76297) CFSTI: HC $2.00/MF $0.50 CSCL 09C

Results are presented of an analytical and empirical investigation of the phase delay characteristics of a crystal mixer. The phase shift incurred by a sinusoidal wave in passing through a crystal mixer is treated from both an analytic and empirical viewpoint. Results from these two approaches agree well with respect to the form of phase shift as a function of the controlled variables and are in fair quantitative agreement between each other. From the results, an operating condition is obtained that minimizes the phase shift change through a crystal mixer for reasonable variations in the controlled variable. R.N.A.

N66-30823# Atomic Energy Commission Research Establishment, Riso (Denmark). Electronics Dept.

PULSE-HEIGHT DISCRIMINATOR

J. M. Diamond May 1965 42 p

(RISO-102)

A solid state pulse-height discriminator with a voltage range of 0.4 to 10 V is described. A detailed analysis of the operation of the discriminator is included, together with the results of some stability tests. NSA

N66-30853*# Auburn Research Foundation, Inc., Ala. Radio Frequency Tracking Lab.

A COMPARATIVE STUDY OF THE BALANCED AND SINGLE-ENDED MIXERS IN THE PRESENCE OF LOCAL-OSCILLATOR NOISE Technical Report No. 7

H. M. Summer 30 Oct. 1964 51 p refs

(Contract NAS8-5231)

(NASA-CR-76359) CFSTI: HC $3.00/MF $0.50 CSCL 09A

The ability of the balanced mixer to reduce local-oscillator noise is investigated by comparing the outputs of a balanced and a single-ended mixer when the local-oscillator signal is summed with and modulated by a simulated noise signal. This comparison is made analytically as well as experimentally. In addition, the outputs of the single-ended and balanced mixers are compared experimentally for the cases where the local-oscillator signal is summed with and modulated by band-limited random noise. It is shown in all cases that the balanced mixer significantly reduces the amount of noise in the mixer output for the two types of local-oscillator noise studied. Author

N66-30854*# Auburn Research Foundation, Inc., Ala. Radio Frequency Tracking Lab.

THE DEGRADATION OF SIGNAL-TO-NOISE RATIOS IN A CRYSTAL MIXER Technical Report No. 6

H. M. Summer 20 Aug. 1964 17 p refs

(Contract NAS8-5231)

(NASA-CR-76360) CFSTI: HC $1.00/MF $0.50 CSCL 09A

This study was conducted to determine the minimum degradation in the input signal-to-noise ratio to be expected from a crystal diode mixer. Considerable effort was devoted to the development of a valid technique for measuring the minimum noise figure of a crystal diode mixer. Two separate techniques were used in an attempt to obtain experimental data on the noise figure. The first technique used a carrier signal modulated with noise while the other utilized a carrier signal with added noise as the input to the receiver. The study results are inconclusive. It is believed that the basic approach to the problem is sound and involves measuring only a few relatively simple quantities, but difficulties were encountered in obtaining accurate measurements of the quantities. R.N.A.

N66-30930# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

FURTHER DEVELOPMENT OF A HIGH-SPEED ELECTRON-MULTIPLIER DISCRIMINATOR FOR MASS-SPECTROMETER ION DETECTION

A. B. Hance and L. R. Hanrahan 21 Feb. 1966 10 p ref

(Contract W-31-109-ENG-52)

(KAPL-3122) CFSTI: HC $1.00/MF $0.50

A solid-state high-speed discriminator-amplifier was designed to detect negative output pulses from a high-gain electron multiplier. The input threshold sensitivity is 2 to 4 mv, and the output circuit develops ~ −2.8 volts when loaded

into 50 ohms. A continuous distribution of random amplitude pulses above the input threshold produces output pulses than have <1% amplitude modulation. When used in a mass-spectrometer ion-detection system, count rates up to several megahertz can be detected. The dead time for random-pulse detection is 12 nanosec or less. Author (NSA)

N66-30987# Stanford Univ., Calif. Linear Accelerator Center.

COMPACT PHOTOMULTIPLIER-TUBE BASE

Arpad Barna and Adam Boyarski [1964] 7 p refs
(Contract AT(04-3)-400)
(TID-21362) CFSTI: HC $1.00/MF $0.50

A small-size photomultiplier-tube base for the 6810A and 58AVP photomultiplier tubes was constructed. A schematic diagram is shown. The base operates on a negative high voltage of 0 to −3 kv. The dynode divider chain has a resistance of approximately 2.7 MΩ. Dynodes 10 to 14 are accessible via a multicontact connector for the connection of additional capacitors and/or voltage stabilization. NSA

N66-31013# Montana State Coll., Bozeman. Electronics Research Lab.

STUDY OF PROBLEMS WITH ROSSI SWEEP APPLICATIONS Final Report

Robert C. Seibel Jan. 1966 79 p refs Prepared for Calif. Univ., Livermore, Lawrence Radiation Lab.
(Contract W-7405-ENG-48)
(UCRL-13199) CFSTI: HC $3.00/MF $0.50

The two types of Rossi signal feed systems presently in use by LRL were analyzed and compared. The methods presently used by LRL for Rossi Signal coupling were studied. The maximum allowable Rossi oscillator signal distortion which the various Rossi mixing systems can tolerate was determined. The feasibility of transistorizing the Rossi oscillator circuits was investigated. The feasibility of a phase-locked Rossi oscillator system and an oscillator unit integral with each oscilloscope was investigated. An experimental Rossi mixer unit is presented which was found to possess extremely high distortion toleration capabilities. NSA

N66-31029# Hahn-Meitner-Institut fuer Kernforschung, Berlin (West Germany).

LOW TIME SHIFT DIFFERENTIAL DISCRIMINATOR [EIN DIFFERENTIAL-DISKRIMINATOR MIT GERINGER ZEITVERSCHIEBUNG]

J. Lauch and H. U. Nachbar Mar. 1966 17 p refs In GERMAN
(HMI-B-47)

A differential discriminator for measuring D- and DD-clipped pulses with a duration of 0.2 to 7.5 μs and RC-clipped pulses with a decay time constant of max. 5 μs is described. Channel level and channel width are adjustable between approx. 0.1 and 10/V. The discriminator allows differential and integral operation and can be triggered at a selectable point on the leading edge or the crossover point of the input pulses. The output signal can be delayed in the range of 1 to 4 μs with negligible time shift depending on the pulse amplitude. Author (NSA)

N66-31086# Atomic Energy Commission Research Establishment, Riso (Denmark).

QUARTERLY REPORT OF THE ELECTRONICS DEPARTMENT FOR THE PERIOD APRIL 1–JUNE 30, 1965 [BERETNING OM ARBEJDET I ELEKTRONIKAFDELINGEN I TIDEN 1. APRIL TIL 30 JUNI 1965]

Sep. 1965 62 p refs
(RISO-M-313)

The development progress made in the PBP 8 computer system, 7 V experiment counting equipment for research installations, punched tape reader unit, instrumentation for loop studies for heavy water fuel plates in the DR-3 reactor, counting instrumentation for irradiation research, electrometers for logarithmic amplifier elements, beam sweep generators, redundancy principle for logical elements, block diagrams of electron tubes, dimensions of electron tubes, dimensioning of numerical control systems, and transistorized electrometer amplifier are reported. NSA

N66-31099# Illinois Univ., Urbana. Dept. of Computer Science.

AN APPLICATION OF INTERCOUPLED-TRANSMISSION-LINE-AMPLIFIER

Chushin Afuso 1 Nov. 1965 23 p refs
(Contract Nonr-1834(15))
(Rept.-193; AD-628870) CFSTI: HC $1.00/MF $0.50

An attempt has been made to use an intercoupled transmission line with tunnel diodes as a pulse amplifier for driving, in particular, high-speed diode logic circuits. For this purpose hot-electron diodes were used. The voltage swing of the amplifier is limited by the characteristics of tunnel diodes. It is not large enough to drive hot-electron diodes without bias. Hence it is necessary to bias the diodes properly. A satisfactory result was obtained for the case where the overall voltage gain, including voltage attenuation due to internal resistance of hot-electron diodes, was less than unity. Further trails to obtain a higher voltage gain have been done. The results were not satisfactory, however. Author (TAB)

N66-31103# Northrop Corp., Newbury Park, Calif. Nortronics Applied Research Dept.

STUDY FOR GENERALIZED MODEL FOR SEMICONDUCTOR RADIATION RESPONSE PREDICTION Second Quarterly Progress Report, 15 Mar.–15 Jun. 1966

James P. Raymond and William W. Chang Sep. 1965 72 p refs
(Contract DA-28-043-AMC-00423(E))
(NVR-3920; ECOM-00423-2; AD-625341) CFSTI: HC $3.00/MF $0.75

Investigations included the further study of grown junction diodes and transistors, and the initial study of the transistor element of a monolithic chip integrated circuit. The ionizing radiation response of the diode was calculated using the known values of diode recovery time and junction area. Calculated and observed photocurrents are within a factor of two. The common-emitter response of the grown-junction transistor was calculated. The openbase and small-signal transistor response was obtained from electrical parameter measurement and the collector photocurrent with source resistance of zero. Discrepancies between calculated and observed waveforms are attributed to variations in common-emitter current gain and carrier motion by drift in the collector region. Ionizing radiation effects in an integrated circuit transistor element were studied analytically and experimentally. The lumped model demonstrates the motion of carriers generated in the collector region to the base or substrate regions. The common-emitter response is used to show the influence of the substrate photocurrent on the total observed collector current. Neutron-induced lifetime degradation was directly introduced in the transistor lumped model to give the expected form of transistor gain reduction. The results compare favorably to the Messenger–Spratt prediction. Author (TAB)

N66-31116# General Electric Co., Auburn, N. Y. Semiconductor Products Dept.
RESEARCH AND DEVELOPMENT OF SILICON CONTROLLED RECTIFIERS FOR HIGH FREQUENCY AMPLIFIER APPLICATIONS Quarterly Progress Report, 16 Jul.–16 Oct. 1965
[1965] 36 p
(Contract NObsr-91299)
(QPR-4; AD-623903) CFSTI: HC $2.00/MF $0.50

The current rating and transient temperature distribution of the device are discussed, followed by a description of the cathode pattern employed. Electrical test data on the state-of-the-art devices and other devices constructed during the quarter are also presented. Author (TAB)

N66-31125# Varian Associates, Palo Alto, Calif.
STUDY OF A 100-WATT Ku-BAND TRAVELING WAVE TUBE Quarterly Report No. 2, 1 Oct.–31 Dec. 1965
S. Paul Otsuka Mar. 1966 22 p refs *Its* Rept.-2
(Contract DA-28-043-AMC-01514(E))
(ECOM-01514-2; AD-626219) CFSTI: HC $1.00/MF $0.50

The preliminary electrical design was completed except for the helix to waveguide transitions. The PPM focusing stack was designed, fabricated and measured. A beam tester was constructed, exhausted, cathodeprocessed and made ready for test. Studies of efficiency improvement were made using a velocity taper for the helix slow wave structure. Author (TAB)

N66-31131# Michigan Univ., Ann Arbor.
INVESTIGATION OF LARGE-SIGNAL KLYSTRON AND TRAVELING-WAVE DEVICES Quarterly Report, 1 Jun.–1 Sep. 1965
G. T. Konrad and J. E. Rowe Griffiss AFB, N. Y., RADC, Dec. 1965 49 p refs
(Contract AF 30(602)-3569)
(RADC-TR-65-430; AD-626806) CFSTI: HC $2.00/MF $0.50

The behavior of Brillouin beams in TWA's is evaluated. The effects of magnetic field strength, as well as other parameters, on the beam geometry and the rf voltage buildup along the beam are presented. The radial distribution of electrons at the saturation plane is also determined for typical operating parameters. The continuation of work on the nonlinear, boundary-value problems in electron and plasma devices is described. A method of integrating the equations is presented and the error propagation in the solution is discussed. Experimental results obtained in the beam analyzer on a solid-beam gun are described. This gun is to be used eventually in the beam stability experiments in the presence of large-signal rf. The magnetron injection gun computer program work is described. The cathode current density can now be reliably handled in the program, but cycloiding problems at the cathode are still shown to be present. The initial results from testing the uhf tube containing a magnetron injection gun are discussed. Future plans for this work are outlined. Operation under cw conditions is shown to be necessary in order to obtain noise measurements on the tube. Author (TAB)

N66-31143# Army Foreign Science and Technology Center, Washington, D. C.
THE QUESTION OF CALCULATING THERMAL COMPENSATION IN OSCILLATORY CIRCUITS. STABILIZATION OF THE OSCILLATION PERIOD OF THE BALANCE WHEEL IN A NEW TYPE ESCAPEMENT REGULATOR WITH RESTRICTED MOVEMENT
L. D. Vishnevskiy and Z. M. Aksel'rod Feb. 1966 35 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedeni, Priborostr. (Leningrad), no. 3, May–Jun. 1961 p 11–18, 83–94
(FSTC-HT-23-39-66; TT-66-60983; AD-630929) CFSTI: HC $2.00/MF $0.50

A method is presented for selecting the values of capacitors to be used in the temperature-compensating circuits of temperature-stable oscillators. Parallel and series connected compensators are considered. Temperature compensation by variable capacitor is briefly discussed. A new type of escapement regulator, with restricted movement is described, and its dynamic characteristics are presented. In the new type escapement, the geared wheel moves one notch when the balance wheel, with one slot, moves in one direction, remaining stationary when the balance wheel returns. The simplified design makes the period less dependent on the force applied to the movement wheel. Author (TAB)

N66-31179# ITT Kellogg, Chicago, Ill.
FEASIBILITY MODEL DEVELOPMENT DROP AND INSERT EQUIPMENT FOR MULTIPLEX Final Report, May 1964–Feb. 1965
Joseph F. Doyle and Foster W. Frazee Griffiss AFB, N. Y., RADC, Oct. 1965 142 p
(Contract AF 30(602)-3429)
(RADC-TR-65-220; AD-624100) CFSTI: HC $4.00/MF $1.00

The principal aim of the work described herein was the development and construction of a practicable single channel Drop and Insert Multiplex System having a twelve channel selection capability in the 'B' group from 60 KC to 108 KC. Secondary aims were analytical verification of design feasibility as applied to 'A' group frequencies from 12 KC to 60 KC and investigation of state-of-the-art miniaturization techniques in circuitry and packaging. A singlestep modulation and demodulation plan was used with band stop–band pass filters operating at group channel frequencies. Identical phase and amplitude equlaizers were installed in the drop circuitry and in the insert path. Out-of-band signalling facilities were included. Engineering feasibility model consisted of a relay rack mounted, externally powered, full duplex common equipment unit (voice frequency and signalling circuitry) with 12 sets of plug-in band stop–band pass filter and carrier oscillator subassemblies. Final system tests indicated some improvement is desirable in pass band ripple, particularly in the higher frequency channels. Crosstalk, carrier suppression, distortion and other transmission characteristics were satisfactory. Author (TAB)

N66-31192# Atomic Weapons Research Establishment, Aldermaston (England).
ELECTROSTATICALLY-FOCUSSED IMAGE TUBES
A. E. Huston Paris, ESRO, Nov. 1965 10 p refs
(ESRO-SM-7) CFSTI: HC $1.00/MF $0.50

Image tubes may be focused either by a combination of electric and magnetic fields ('magnetic focusing') or by electric fields alone ('electrostatic focusing'). Magnetic focusing is widely used in the image section of the image orthicon television camera tube, as well as in the Vidicon and C.P.S. Emitron. Electrostatic focusing is used in military applications, high-speed photography, electronography and in medical applications where a high degree of demagnification is desirable. After a summary of the performance of these tubes the author concludes that for optimum results, spherical

photocathode surfaces are essential and that resolution can be maintained and distortion minimized if the focus electrode has a diameter about 4 times that of the photocathode itself. Author

N66-31193# European Space Technology Center, Noordwijk (Netherlands).
THE EFFECTS OF AN IONIZED GASEOUS ENVIRONMENT ON THE SURFACE PROPERTIES OF A TRANSISTOR
M. J. Downey Paris, ESRO, Feb. 1966 31 p refs
(ESRO-TN-11)

The article deals first with calculation of the radiation dose rate expected in the transistor (2SO24 type) can in the UK-3 Satellite. Next the laboratory simulation of this radiation environment and the apparatus used are described. The technique used for measuring the dose rate in the experiment is then given and this is followed by a description of the various collector reverse current measurements showing the significant increases which can occur due to this phenomenon. Finally, conclusions are drawn on the usefulness of the experimental arrangement and on the advantages of varnishing the transistor device where possible in satellite applications. Author

N66-31249# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
HIGH SPEED SEMICONDUCTOR SWITCH (TWO TERMINAL) AND HIGH SPEED SEMICONDUCTOR SWITCH (GATE) Quarterly Report, 29 Nov. 1965–28 Feb. 1966
[1966] 16 p
(Contract DA-36-039-AMC-01475(E))
(QR-11; AD-633141) CFSTI: HC $1.00/MF $0.50

The report presents results obtained from preproduction testing of a 2N1765 device lot, solutions to problems involving leakage current, dv/dt, and turn-on time, and descriptions of work performed on life test facilities. Author (TAB)

N66-31302# Radio Corp. of America, Camden, N. J. Communications Systems Div.
MICROMODULE LIFE TEST PROGRAM Quarterly Progress Report, 17 Jun.–17 Sep. 1965
[1965] 49 p refs *Its* Rept.-4
(Contract DA-36-039-AMC-01462(E))
(QPR-4; AD-632839) CFSTI: HC $2.00/MF $0.50

A total of 2674 micromodules remained on life-test at the beginning of this quarter and twenty-two failures occurred during this period. Included in the number of failures for the XM-1364 modules are 41 failures that were caused by inserting the module in the test socket or the life test board in the wrong position which results in the wrong voltages being applied to the module riser wires causing permanent module damage. Author (TAB)

N66-31305# General Electric Co., Oklahoma City, Okla. Military Communications Dept.
MATRIX CONTROLLED DISPLAY DEVICE, PHASE II Final Engineering Progress Report, 5 Jan. 1965–5 Mar. 1966
25 May 1966 94 p
(Contract NObsr-89334)
(AD-633358) CFSTI: HC $3.00/MF $0.75

The report describes progress to develop a matrix display with 200×2000 discrete elements on a 10×10 foot screen by using in-air thermoplastic recording and TIRP (Total Internal Projection Prism) projection techniques. a feasibility model was constructed which provides a 25×25 elemental portion of the full-scale display by the optical readout of deformations on a thin film of thermoplastic. Information is recorded on the thermoplastic by the coincident switching of crossed-grid electrodes on 2-mil centers. Tests show that the in-air recording process inherently provides a non-linearity at each non-addressed cell to prevent its partial excitation when addressed cells are written. The present recording resolution of 500 elements per linear inch provides information storage at a density of 250,000 discrete elements per square inch. At ambient, the information is permanently stored. Storage time decreases with increasing thermoplastic temperature to under a second at 100°C. Fabrication of a 2000×2000 matrix for the full-scale display was initiated. Initial results using KPR as an evaporation resist to directly form the indium oxide electrodes indicate that a 2000×2000 matrix with very few, if any, defects can be fabricated. Author (TAB)

N66-31324# Naval Research Lab., Washington, D. C.
SCALING UNDERWATER EXPLODING WIRES Interim Report
James R. Mc Grath 17 Dec. 1965 31 p refs
(NRL-6266; AD-633115) CFSTI: HC $2.00/MF $0.50

Five-mil Nichrome wires have been exploded under water using a 1/2-μf capacitor which stored energy up to 100 joules. The results indicate that peak pressure scales like a chemical explosive if losses due to the circuit and joule heating of the wire itself are accounted for. On this basis, the equivalent weight of TNT represented by the electrical energy stored in the capacitor is

$$W = 525(0.325CV_0^2 - E_v)/H_D$$

where W is the weight in micropounds, C is the capacitance in farads, V_0 is the initial charging voltage, E_v is the estimated energy dissipated by the wire in joules, and H_D is the heat of detonation of TNT in calories per gram. This scaling behavior extends the law of similarity six decades in terms of weight, from pounds to micropounds. The peak pressure for exploding-wire phenomena has been obtained from data and is empirically expressed as

$$p_m = 26.800\,(W^{1/3}/R)^{1.08}$$

where p_m is peak pressure and R is pressure-gage distance. The instrument response to the short-duration shock wave gives rise to a new definition of the explosion constant τ_e. The reduced time-constant parameter shows qualitative agreement in value and slope with chemical data scales, and is given empirically as:

$$\frac{\tau_e}{W^{1/3}} = 70\left(\frac{W^{1/3}}{R}\right)^{-0.22}$$

Author (TAB)

N66-31327# Naval Research Lab., Washington, D. C.
LINEAR CLASS B AUDIO AMPLIFIER OUTPUT-POWER CAPABILITY: ANALYSIS OF LOAD-IMPEDANCE AND WAVEFORM EFFECTS Interim Report
Wilmer M. Lawson, Jr. 13 Apr. 1966 21 p
(NRL-6379; AD-633117) CFSTI: HC $1.00/MF $0.50

Large amounts of electrical power at audiofrequency are usually provided by some form of class B electronic amplifier. Unfortunately, changes in load impedance and in waveform can result in very large reductions in the output-power capability of such amplifiers. The design equations for class B amplifiers are developed with respect to impedance and signal waveshape. Manipulation of the equations leads to proof that class B amplifier operation with any signal waveshape can be assumed to be the same as operation with a sine wave of the same root-mean-square value. Therefore, once the sine-wave capability of a class B amplifier is determined, its capability for other waveshapes is determined by application of a simple derived multiplication factor. The sine-wave capability of class B amplifiers has been determined and presented in the form of graphs of power versus magnitude of impedance for fixed power factors and device peak-voltage capabilities. In general, the optimum sine-wave-output capability is determined as the power-dissipation capability of each device multiplied by 4.93, provided the current limit is not exceeded. The actual output capability will be reduced in magnitude by load and signal effects and system efficiency. This reduction is of the order of ten for loads with power factor of 0.7 and impedance swing of 4:1 and for device efficiency of 70 percent and circuit efficiency of 92 percent. For signals other than sine waves, the sine-wave average-power capability is then further reduced and is determined, in the worst case, by multiplying the sine-wave capacity by two and dividing by the square of the crest factor. Author (TAB)

N66-31330# Naval Avionics Facility, Indianapolis, Ind.
TRANSFER OF FABRICATION TECHNOLOGIES OF THIN FILM ACTIVE AND EXTREME ENVIRONMENT PASSIVE DEVICES Final Report
Michael G. Cowart and William Mc Guire 15 Mar. 1966 199 p refs
(NAFI-TR-750; AD-633009) CFSTI: HC $5.00/MF $1.25

The report describes the transfer of vacuum deposition technologies relative to thin film active devices and high temperature passive devices from Melpar, Incorporated, to the U.S. Naval Avionics Facility, Indianapolis. Detailed descriptions are included of apparatus, materials, test equipment, fabrication procedures, and process parameters. Author (TAB)

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N66-29996# Army Electronics Lab., Fort Monmouth, N. J.
RESTORATION OF THE INPUT FUNCTION IN MEASURING INSTRUMENTATION
Heinz Grote Feb. 1966 151 p refs
(ECOM-2662; AD-632598) CFSTI: HC $4.00/MF $1.00

The subject of this investigation is the extension of the dynamic range of a given measuring instrumentation by external means. If the output–input relation of the instrument is presented in the form of an ordinary differential equation, it is possible to restore the input far beyond the instrumental restrictions by computational means. A main operation involved in this process, differentiation, is treated from an instrumentational point of view. Examples of the input restoration for linear and nonlinear differential equations are presented. Author (TAB)

N66-30010# Israel Inst. of Tech., Haifa.
ULTIMATE-DEFINITE AND SYMMETRIC-DEFINITE EVENTS AND AUTOMATA
A. Paz and B. Peleg (Hebrew Univ.) Feb. 1965 25 p refs Prepared jointly with the Hebrew Univ.
(Contract N62558-3882)
(TR-17; AD-631860) CFSTI: HC $1.00/MF $0.50

A generalization is presented of the definite automaton and definite event, an ultimate–definite event concept is introduced, and a decision procedure is given for determining whether a finite automaton is an ultimate–definite event. A decision procedure is also presented for symmetric automata, and a canonical representation is shown for this type of event. Definitions are given, theorems and their proofs and sufficiencies are detailed. M.W.R.

N66-30047# Joint Publications Research Service, Washington, D. C.
IZVESTIYA VUZOV: INSTRUMENT BUILDING, VOL 9, NO. 1, 1966
27 Jun. 1966 308 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Priborostr. (Leningrad), v. 9, no. 1, 1966 p 1–159
(JPRS-36210; TT-66-32643) CFSTI: $5.00

Papers on operation and design of instruments for use in radioelectronics, electrical measurement, automation, mechanics, optics, navigation and gyroscopes, and thermal measurement are presented. For individual titles see N66-30047–N66-30075.

N66-30047# Joint Publications Research Service, Washington, D. C.
PHOTOELECTRONIC INSTRUMENTS: COMMUTATION OF A PHOTO-DIODE MULTIELEMENT BAR (THE SCANISTOR)
K. F. Berkovskaya and V. L. Kreytser *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 1–10 refs (See N66-30046 17-10) CFSTI: $5.00

A commutation system of a photodiode sensor series based on the scanning of two-diode cells by a saw tooth voltage is described. Calculation relationships are derived which make it possible to determine the resolving capacity of the device and the value of the signal produced. Several examples of the application of the described device for the automatic measurement and indication of manufactured articles are given. Author

N66-30048# Joint Publications Research Service, Washington, D. C.
ON REGULATION OF AMPLIFICATION IN A PHASE RADIO RANGE FINDER
P. M. Golubev *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 11–16 refs (See N66-30046 17-10) CFSTI: $5.00

Parasitic phase shifts due to the presence of the cutoff in the anode current of the regulated stage are considered with the regulated stage representing a resonant amplifier in whose load the first harmonic of the anode current is separated. Nonlinear distortions in the regulation of tube amplification are attributed to the presence of the second harmonic in the input signal because the regulated stage is located beyond the amplitude detector. It is shown that parasitic shift changes sharply with changes in the amplifier's operating mode only for those values at which the tube is near the cutoff value. In order to decrease this shift, regulation limits must be narrowed (2 dB for the given case) and nonlinear distortions of the input signal must be decreased. M.W.R.

N66-30049# Joint Publications Research Service, Washington, D. C.

THE QUESTION OF PASS BAND WIDTH IN NOISE-MEASURING DEVICES

U. A. Polyakov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 17–20 refs (See N66-30046 17-10) CFSTI: $5.00

Determination of relative error in the measurement of low frequency noise coefficients is investigated. It is shown that measurement parameters can be selected by the comparison method by using curves which are properly scaled. An equation is given for determining the required band pass width for a specific meter when the frequency and relative measurement error are known. M.W.R.

N66-30051# Joint Publications Research Service, Washington, D. C.

ON THE PHASE-AMPLITUDE METHOD OF INDEPENDENT BALANCING OF CURRENT COMPARING CIRCUITS

Yu. A. Skripnik and V. P. Karpenko *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 28–35 refs (See N66-30046 17-10) CFSTI: $5.00

Variations of the phase amplitude method for balancing current impedance comparison circuits are evaluated in terms of inductance measurements and the Q-factor of coils. It is shown that independent balancing can be accomplished for circuits with high mutual inductance arms for measuring the parameters of low Q-factor coil inductances, and that the possibility of direct readings of both inductance and Q-factor is preserved. Periodic substitution can be employed to eliminate systematic errors, and synchronous modulators permit the range of measured values to be extended to the region of small inductances. M.W.R.

N66-30053# Joint Publications Research Service, Washington, D. C.

ONE METHOD OF MEASURING SMALL RESISTANCES AND CAPACITANCES

A. A. Bakhtiozin and V. S. Popov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 45–53 refs (See N66-30046 17-10) CFSTI: $5.00

Theoretical and experimental studies are reviewed for an RC generator with comparatively small controlling resistances and capacitances. Capacitors are connected in the positive feedback circuit through transformers which makes it possible to obtain relatively low frequencies. Author

N66-30055# Joint Publications Research Service, Washington, D. C.

INSTRUMENTS AND DEVICES OF AUTOMATION AND TELEMECHANICS: THE INFLUENCE OF RELAY OPERATING TIME ON THE BEHAVIOR OF AN AUTOMATIC SYSTEM

N. N. Myasnikov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 62–69 refs (See N66-30046 17-10) CFSTI: $5.00

The effect of relay operating time on the dynamic properties of automatic self-oscillation relay systems is evaluated by using harmonic linearization principles and the theory of linear systems with delayed links. It is shown that because these effects are both quantitative and qualitative, the combined method must be utilized in all cases where the nonlinear system has links which introduce pure delay time. Establishing parameters of self-oscillation modes are considered in the presence of one relay element, and the analysis is extended to a third order relay system of general form. It is shown that if conditions of harmonic linearization are established, the area of generalized parameters is divided into three regions; in one the relay system is stable for any initial deviation. In the second there is a fixed self-oscillation mode when the delay is zero or very small, and in the third this fixed mode remains at increased delays. When delay is neglected, only two regions are obtained; one has no periodic modes and the other combines the two regions with fixed modes. M.W.R.

N66-30056# Joint Publications Research Service, Washington, D. C.

LOSS OF POWER IN SEMICONDUCTOR FREQUENCY INVERTERS WITH PULSE-WIDTH MODULATION OF VOLTAGE

T. A. Glazenko *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 70–79 ref (See N66-30046 17-10) CFSTI: $5.00

Power indicators of semiconductor frequency inverters are considered. A method is given for the calculation of the switching power of transistors, and the method of selecting the carrier frequency is discussed. Author

N66-30057# Joint Publications Research Service, Washington, D. C.

CALCULATION OF TRANSIENTS IN THREE-PHASE POWER MAGNETIC AMPLIFIERS

A. A. Krasnoproshina *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 80–85 refs (See N66-30046 17-10) CFSTI: $5.00

Nonlinear operating characteristics of magnetic amplifiers, nonlinear volt-ampere characteristics of the rectifiers, and the change in time constant are considered in the evaluation of a graphical engineering method for determining the dynamics of three-phase magnetic amplifiers with resistive-inductive loads. Equations are given for the calculation of transients, and the curves which result from such calculations are found to be in good agreement with test results. M.W.R.

N66-30059# Joint Publications Research Service, Washington, D. C.

ABOUT THE OPTIMUM CONTROL OF THE INDEPENDENT EXCITATION MOTOR WITH TWO GOVERNING EFFECTS

Yu. A. Bychkov and L. P. Smol'nikov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 92–98 refs (See N66-30046 17-10) CFSTI: $5.00

Basic features are considered for a speed control optimal for a direct current motor with independent excitation when the voltage applied to the armature and the excitation current is varied. A method is given for the calculation of optimal control of these motors which can lead to the design of devices that will provide optimal operating modes. It is assumed that the output coordinate is the speed of rotation and that the control movement can be obtained by changing armature voltage within imposed limits or voltage in the excitation winding. The case is considered in which the time constant of the excitation winding affects the transition process to a considerable degree. The object of control is nonlinear, and initial equations are written using relative units and neglecting the saturation of the motor magnetic system. Control regions of the investigated system are graphed, as is the transition process curve. An error of one percent is found in reaching the desired control value. M.W.R.

N66-30060# Joint Publications Research Service, Washington, D. C.

THE CALCULATION OF SERIAL AUTOMATIC REGULATORS ADJUSTMENT FOR ONE CLASS OF CONTROLLED UNITS

E. Ya. Rapoport *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 99–107 ref (See N66-30046 17-10) CFSTI: $5.00

Problems in the adjustment of automatic regulators are investigated by the harmonic linearization method. In many industrial processes with sufficiently large time constants it is advantageous to use auto-oscillating modes of control system operation at acceptable frequencies of the process. Such a system has the advantages of great dynamic precision, small control time, power economy, and simple combination of regulation and remote control functions into one controlling device. The simplest positional controllers can usually be used only for small delay times in temperature control processes. In the general case, sufficiently small oscillation amplitudes and statistical errors can be obtained by using serial automatic regulators in an auto-oscillating mode with a generalized transfer function. Author

N66-30061# Joint Publications Research Service, Washington, D. C.

COMPUTATIONAL INSTRUMENTS AND DEVICES: STABILITY OF AN ELECTRONIC MATHEMATICAL MODEL FOR SOLVING A DIFFERENTIAL EQUATION

A. N. Lebedev *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 108–113 refs (See N66-30046 17-10) CFSTI: $5.00

Concepts and definitions of stability are considered in the strict and approximate senses, and various models are formulated for investigating both structural and approximate stability of an electronic mathematical model for solving a differential equation. It is pointed out that a model which is unstable in the approximate sense is also unstable in the strict sense, but that a model which has approximate stability may be either stable or unstable in the strict sense. If the linear differential equation contains free-play nonlinearity or dead zones, the structural stability of the model is not disturbed but it becomes difficult to investigate the approximate stability. Structural stability of the model may be violated if the equation has variable coefficients, and in such cases determination of approximate stability becomes even more complex. M.W.R.

N66-30062# Joint Publications Research Service, Washington, D. C.

A METHOD OF ERROR MODELLING DIGITAL CONTROL SYSTEM TRANSDUCERS

G. I. Novikov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 114–116 (See N66-30046 17-10) CFSTI: $5.00

Methods are proposed for representing transducer errors in modeling digital control systems using universal digital computers. Values for the transducer errors are determined during modeling by maximizing the errors at the system output. Author

N66-30063# Joint Publications Research Service, Washington, D. C.

DISCRETE SMOOTHING DEVICES

V. F. Vlasov *In its* Izv. VUZov: Instr. Bldg. 7 Jun. 1966 p 117–123 refs (See N66-30046 17-10) CFSTI: $5.00

We consider the problem of smoothing a steady-state random noise n(t) by a discrete smoothing device (DSD) assuming a given rms error in reproducing the random steady-state useful signal m(t) and a required dynamic accuracy in reproducing the control signal x(t) at discrete times. A w-converter and the concept of an absolute quasi-frequency $\lambda = 1/j(2/T_0)w$ are used. In this case, we can use a technique for investigating continuous smoothing devices (SD) and shift from the DSD to the corresponding continuous SD relatively simply. Author

N66-30064# Joint Publications Research Service, Washington, D. C.

SIMPLE WIDEBAND AC INTEGRATOR

V. I. Gostev *In its* Izv. VUZov: Instr. Bldg. 7 Jun. 1966 p 124–127 ref (See N66-30046 17-10) CFSTI: $5.00

This article describes a wideband AC integrator circuit intended for correcting an automatic control system working on the carrier frequency. The equivalent (for an amplitude-modulated voltage envelope) transfer ratio and the results of the experimental investigation of the circuit are given. Author

N66-30065# Joint Publications Research Service, Washington, D. C.

PRECISION MECHANICS INSTRUMENTS: CALCULATING THE STABILITY OF AN ELECTRONIC TIME RELAY

Ye. F. Shkalov and M. P. Tsygankov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 128–132 refs (See N66-30046 17-10) CFSTI: $5.00

The modern level of industrial development requires the use of high-precision automatic devices. It is necessary to have a time delay in a number of processes where in some cases greater demands are made on its stability. In circuits of interrupters and converters changing continuous quantities into discrete actions repeating in time, operation precision of the entire device as a whole is determined. This article considers analytical relationships for selecting electronic time relay circuit elements. Author

N66-30080*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THEORY OF OPEN-ENDED CIRCULAR CYLINDRICAL MICROWAVE CAVITY

Norman C. Wenger Washington, NASA, Jul. 1966 40 p refs (NASA-TN-D-3514) CFSTI: HC $2.00/MF $0.50 CSCL 09C

The TE_{011} mode of oscillation in an open-ended circular cylindrical microwave cavity is discussed. The cavity consists of a circular waveguide terminated at each end with a thin cylindrical partition coaxial with the circular waveguide. The resonant frequency of the cavity is computed by using Laplace transform and Wiener–Hopf techniques. Numerical values for the resonant frequency are presented. M.W.R.

N66-30172*# Auburn Research Foundation, Inc., Ala. Sampled-Data Control Systems Group.

DIGITAL COMPENSATION OF THE THRUST VECTOR CONTROL SYSTEM Technical Report No. 2, 13 Nov. 1964–28 May 1965

28 May 1965 85 p refs

(Contract NAS8-11274)

(NASA-CR-76103) CFSTI: HC $3.00/MF $0.75 CSCL 09C

Open-loop pulsed transfer functions of the simplified thrust vector control system for a Saturn-type vehicle with an unsampled input are derived by the fictitious sampler and fictitious hold method and by the describing function method. Both methods are approximate with accuracy depending on the low-pass nature of the system. Typical examples of both methods are given. Author

N66-30281*# Tennessee Univ., Knoxville. Dept. of Electrical Engineering.
ADAPTIVE CONTROL SYSTEMS, A GENERAL CLASSIFICATION SCHEME Technical Note No. 2
N. K. Sinha 30 Oct. 1964 18 p refs
(Grant NsG-351)
(NASA-CR-59544) CFSTI: HC $1.00/MF $0.50 CSCL 09C

A scheme of classification of adaptive control systems is proposed. It is shown that a large variety of so-called adaptive, self-optimizing, learning and other systems can be fitted into this scheme. The scheme divides all adaptive systems into three classes, namely, basic adaptive systems, static adaptive systems, and dynamic adaptive systems. Examples are given to illustrate the classification. Author

N66-30310# Notre Dame Univ., Ind. Dept. of Electrical Engineering.
PSEUDO-LINEAR GENERALIZED SHIFT-REGISTERS
Thomas T. Kubista and James L. Massey 22 Jun. 1966 26 p refs
(Grant NSF GP-2547)
(EE-664)

A method is developed for finding the states of a monotone generalized feedback shift-register (GFSR) which lie on pure cycles, i.e., are also on cycles of the generalized pure-cycling register. The pseudo-linear GFSR, a special case of the monotone GFSR, is studied in detail. The existence of pure cycles for this register is related to the solution of a set of nonlinear algebraic equations. It is shown that, by setting certain variables to zero, a set of linear equations can be determined whose solution is also a solution to the original nonlinear set. As a consequence, it is shown that every pseudo-linear GFSR contains at least two pure cycles. Stability in the sense of Liapunov is then considered for pseudo-linear GFSR's. The origin is shown to be asymptotically stable for all pseudo-linear GFSR's, but never asymptotically stable in the large. A spherical region of asymptotic stability is obtained for sample-data GFSR's using the direct method of Liapunov. Author

N66-30405*# Georgia Inst. of Tech., Atlanta. School of Electrical Engineering.
A STUDY OF THE LOW-PASS CHARACTERISTICS OF LOADED RC DISTRIBUTED NETWORKS Research Report, Dec. 1, 1964–Mar. 31, 1965
Kendall L. Su and William F. Speights, Jr. [1966] 104 p refs
(Grant NGR-11-002-020)
(NASA-CR-76156) CFSTI: HC $4.00/MF $0.75 CSCL 09C

The effects of terminating impedances on the voltage-transfer characteristics of RC distributed networks are investigated. Four general shapes of these networks are included in the investigation. The terminating impedances are limited to parallel combinations of a resistance and a capacitance. Previous studies of the open-circuit performance of networks from these four general shapes provide a basis for continued investigations of their loaded characteristics. The results of such investigations are presented throughout this paper. Through a comparison of these results it is possible to determine the value of proper shaping of RC thin-film networks that are terminated in parallel resistance-capacitance loads. Author

N66-30514# New York Univ., N. Y. Research Div.
VECTOR AMPLITUDE AND PHASE MEASURING DEVICES
Jack Lustig Oct. 1965 86 p refs
(Contract NObsr-89288; Proj. Sete)
(SETE-210/88; AD-624234)

Except for antennas, all of the equipments discussed are intended to measure electrical vectors having phase angles which are defined in terms of electrical degrees, and which represent the phase relationship of a voltage or current flowing within a circuit. Measurements upon electro-magnetic waves being propagated in space involved knowledge of a more complex set of vector relationships to completely determine the wave structure. Both geometrical and electrical angles are involved, and the electrical angles may involve both physical and electrical phase angles. The antenna pattern recorders listed herein represent a sampling of devices which are useful in measuring the variation of response (of an antenna) with respect to rotation about one or more controlled axes. TAB

N66-30570# Iowa State Univ. of Science and Technology, Ames.
ELECTRONICS IN MASS SPECTROMETRY
Gerald D. Flesch and Harry J. Svec Jun. 1965 81 p
(Contract W-7405-ENG-82)
(IS-1193) CFSTI: HC $3.00/MF $0.75

A review of the fundamental behaviors of the electronic circuits involved in magnetic mass spectrometers is given in non-technical language. Emission regulated current supplies and ion current amplifiers are considered. Both vacuum tube and transistor circuits are discussed. The subject is presented in such a way that one should be able to find somewhere in the compiled circuits, an example of most of the circuits usually found in commercial and home built instruments. Author (NSA)

N66-30601*# Auburn Research Foundation, Inc., Ala.
DIGITAL COMPENSATION OF THE THRUST VECTOR CONTROL SYSTEM Technical Report No. 3, 28 May–28 Sep. 1965
H. M. Summer 28 Sep. 1965 128 p refs
(Contract NAS8-11274)
(NASA-CR-76231) CFSTI: HC $4.00/MF $1.00 CSCL 09C

A new method of analysis of sampled-data control systems with unsampled inputs is presented. The method is applicable to low-pass systems. The results of an investigation into the accuracy of analysis of sampled-data systems in the w-plane are also presented. Nyquist diagrams of a compensated thrust vector control system which is sampled in the ϕ channel are obtained by the describing-function approach. The preliminary results of an investigation into the effects of varying the sampling rate of a sampler in the ϕ channel are included. Author

N66-30611*# Auburn Research Foundation, Inc., Ala.
A STUDY OF QUADRATURE BENDING MODE SIGNAL CANCELLATION BY THE USE OF RC COMMUTATED NETWORKS
C. L. Phillips 21 Apr. 1966 60 p refs
(Contract NAS8-11116)
(NASA-CR-76227) CFSTI: HC $3.00/MF $0.50 CSCL 09A

The development of an approximate steady-state time response expression for an RC commutated network is given. The expression is used in investigating several modifications of a rate gyro blender which utilize RC commutated networks. The RC commutated networks were added to the rate gyro blender system to attain more complete signal cancellation irrespective of the phase relation between the forward and aft input signals. Total cancellation is achieved by cancellation of the inphase and quadrature components separately. The responses of the modifications to various sinusoidal input signals containing quadrature components are compared experimentally. Author

N66-30740# Radio Corp. of America, Princeton, N. J. RCA Labs.
THRESHOLD LOGIC Special Scientific Report No. 1, 1 Oct. 1964–30 Sep. 1965
Kenneth R. Kaplan and Robert O. Winder 29 Oct. 1965 50 p refs
(Contract AF 19(628)-4789)
(AFCRL-66-117; AD-632731) CFSTI: HC $2.00/MF $0.50

The report has four independent sections: (1) 'Testing Synthesis Evaluation' repoets a statistical study of a family of linear-programming test-synthesis procedures; a 'best' method is definitely established. (2) 'Symmetry Types for Threshold Logic' is a tutorial exposition including a careful development of the Goto–Takahasi self-dual type ideas. (3) 'Best Threshold Gate Decisions' reports a comparison, on the 2470 7-argument threshold function representatives, of seven different methods of approximating weights on the basis of Chow parameters; the earlier work with a geometric interpretation is shown best. (4) 'Threshold Gate Networks' reviews the previously discussed 2-algorithm in geometric terms, describes our Fortran implementation of it, and reports an experiment which suggests that only one in fifteen five-argument functions is 2-realizable. Author (TAB)

N66-30763*# Auburn Research Foundation, Inc., Ala.
DIGITAL COMPENSATION OF THE THRUST VECTOR CONTROL SYSTEM Fourth Technical Progress Report, 28 Sep. 1965–28 Jan. 1966
H. M. Summer [1966] 92 p refs
(Contract NAS8-11274)
(NASA-CR-76326) CFSTI: HC $3.00/MF $0.75 CSCL 09C

A discussion of an exact method for the determination of stability margins in any channel of a multiloop sampled data system is given. The stability margins are determined for the attitude channel of the thrust vector control system using a continuous compensation function and a 2.5 Hz sampling rate. A design approach is suggested for the development of digital compensation in the attitude rate channel and examples are given for 25 Hz and 2.5 Hz system sampling rates. The "hidden instability" problem is discussed and general guidelines are given for the prevention of system instability. An introduction to the analysis of multirate sampling systems is presented and several methods of analysis are investigated. Author

N66-30851*# Auburn Research Foundation, Inc., Ala. Radio Frequency Tracking Lab.
AN INVESTIGATION OF A VARACTOR-DIODE MODULATOR Technical Report No. 3
H. M. Summer 8 May 1964 50 p refs
(Contract NAS8-5231)
(NASA-CR-76357) CFSTI: HC $2.00/MF $0.50 CSCL 09C

A simple theory for the design of varactor diode modulators was developed and can be applied to any shunt modulator configuration using a varactor diode as a tuning element. A procedure for selecting a varactor diode to yield optimum modulator performance is also discussed. The measured isolation, insertion loss, and bandwidth agree well with computed values. The varactor modulator provides an isolation in excess of 20 dB and an insertion loss of less than 0.15 dB at the design frequency of 114.5 Mc/sec. The insertion loss is less than 1 dB over a bandwidth of 80 Mc/sec and the 3 dB bandwidth in the isolation mode is about 8%. The maximum power input to the modulator when operating in mode-one is the power required to force the diode into the forward conduction region; any further increase in power results in decreased isolation. The modulator operation is independent of its position in the transmission line from the load and dependent of its distance from the generator. The modulator needs no special techniques to achieve isolation greater than 20 dB. It has the added advantage that characteristics between individual diodes can be compensated by adjusting the tuning elements. The modulator's main disadvantage is its low power handling capability. R.N.A.

N66-30867# European Space Vehicle Launcher Development Organization, Paris (France).
SURVEY OF THE PHASE-LOCK LOOP
E. Cambi May 1966 42 p refs
(ELDO-TM-F-30) CFSTI: HC $2.00/MF $0.50

After a review of the logical principle of the phase-lock loop, and of the possible implementation and performance of the individual blocks of the loop, the optimization of the latter is discussed, following a straightforward line of discussion. The results agree with those found in the literature: it is shown, however, that the optimum determined by Wiener's criterion, is by no means absolute: relatively small deviations from this optimum can improve some performances radically, without sensible deterioration of the others. The explicit lock-in mechanism is discussed in the linear (i.e., 'triangular' or 'sawtooth') approximation. Author

N66-31027# Atomic Energy Commission Research Establishment, Riso (Denmark).
ELECTRONICS DEPARTMENT QUARTERLY REPORT, JULY 1–SEPTEMBER 30, 1965 [BERETNING OM ARBEJDET I ELEKTRONIKAFDELINGEN I TIDEN I JULI TIL 30 SEPTEMBER 1965]
Dec. 1965 18 p In DANISH
(RISO-M-351; R-10-65)

Work is reported on numerical control of mechanical motions, a bridge for measuring chemical concentrations, testing of a β-current neutron detector, prospecting for beryllium currencies in Greenland, determination of the activity of plane circular γ source, transport delay with low readout systems and modifications on a chopper-stabilized operational amplifier. NSA

N66-31032# California Univ., Berkeley. Lawrence Radiation Lab.
MAGNETOSTRICTIVE AND PIEZOELECTRIC READOUT OF SPARK CHAMBERS IN MAGNETIC FIELDS
Leon Kaufman, Victor Perez-Mendez, and James M. Pfab Mar. 1966 15 p refs Presented at Inst. of Elec. and Electron. Engr., Scintillation and Semicond. Counter Symp., Wahington, D. C.
(Contract W-7405-ENG-48)
(UCRL-16536; CONF-660304-5) CFSTI: HC $1.00/MF $0.50

Some methods by which the applicability of the magnetostrictive delay line readout for wire spark chambers can be extended for use in magnetic field regions are described. For fields up to 20 kG iron–cobalt alloy wires with either a coil or a piezoelectric receive transducer can be used. A different method involving the generation of acoustic pulses in nonferromagnetic wires is described. With a piezoelectric receive transducer this delay line is essentially unaffected by magnetic fields. Author (NSA)

N66-31180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A CLASS OF ATTITUDE-CONTROL SYSTEMS OF ARTIFICIAL EARTH SATELLITES

V. A. Bodner, K. B. Alekseyev, and G. G. Bebenin 3 Jun. 1965 24 p refs Transl. into ENGLISH from Russian (FTD-MT-65-119; TT-65-64242; AD-622605)

The report is concerned with the synthesis of circuits of control systems with flywheels and of those with momentum magnetic drive. TAB

N66-31204# Technisch Documentatie en Informatie Centrum voor de Krijgsmacht, The Hague (Netherlands).

SURVEY OF LITERATURE-ELECTRO-TECHNOLOGY [ELECTRO-TECHNIEK LITERATUUROVERZICHT]

7 Jun. 1966 33 p refs In DUTCH, ENGLISH and GERMAN *Its* Vol. 15, No. E-488 CFSTI: HC $2.00/MF $0.50

The following topics are discussed: (1) *Telecommunications*—distortions in trunk radio systems, and applications of quartz crystals; (2) *Microelectronic Technology*—backward diodes, microwave pulsation by ferrite modulator, and thyristor properties; (3) *Electromagnetic Propagation*—rainfall measurements by Q-band propagation, etc.; (4) *Information Retrieval*—antifading code, statistical information retrieval system, and wideband data transmission facility; (5) *Computer Technology*—matrix transformation calculations, probability techniques, etc.; (6) *Computer Programming*—use of macro operations for language translations, program for radar echo distribution, etc.; (7) *Measurement Technology*—safety of electronic measuring apparata, and ac bridge system; (8) *Control Techniques*—optimization in chemical processes, and communications control systems; (9) Interference and Reliability—silicon iron hysteresis, lightning protection, etc.; (10) *Oscillators and Amplifiers*—transistor cascade tube for FM amplification, periodic transformation by diodes, etc; (11) *Network Filters*—low-pass filter design, delay estimate for wiring circuit, etc.; and (12) *Energy Technology*—lightning performance of high voltage systems, capacity estimation for high frequency transmission, and direct energy conversion literature abstract survey. Transl. by G.G.

N66-31224*# Villanova Univ., Pa. Research and Development Div.

COMPUTER-AIDED CIRCUIT ANALYSIS Annual Report, May 15, 1965–May 14, 1966

Tsute Yang and Henry T. Koonce [1966] 182 p refs (Grant NGR-39-023-004)

(NASA-CR-76373) CFSTI: HC $5.00/MF $1.25 CSCL 09C

This report describes research conducted on digital computer-aided analysis of electric circuits. Included are discussions on the results of a literature search of the subject area, a study of the Automated Statistical Analysis and Electronic Circuit Analysis digital computer programs, the adaptation of current techniques of computer-aided analysis to the moderate size computer, on-line experience in time sharing computing systems, the accuracy of the Monte Carlo Method, and the generation of random numbers on the IBM 1620 computer. R.N.A.

N66-31290 Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.

SOME RESULTS IN DELAY-DIFFERENTIAL SYSTEMS

Gene A. Kemper Apr. 1966 25 p refs *Its* Mathematical Note No. 458

(D1-82-0519; AD-633089) CFSTI: HC $1.00/MF $0.50

Significant advances in automatic control theory have utilized a powerful technique due to A. M. Liapunov, the so-called Liapunov's direct method. Recent extensions of control theory include time-lag control systems, that is, control systems described by delay-differential systems (sometimes called differential equations with past history). In such investigations the existence of periodic or almost periodic behavior is often of importance. Such investigations afford one possible application of the ensuing work. Author (TAB)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N66-30171*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.

APOLLO/SATURN IB FLIGHT SAFETY PLAN, VEHICLE AS-203

1 Jun. 1966 20 p

(NASA-TM-X-57587; K-IB-02.13/3) CFSTI: HC $1.00/MF $0.50 CSCL 16A

The flight safety requirements, restrictions, and instrumentation necessary for each launch, as authorized by the Apollo test requirements, are defined; the plan is applicable during the launch countdown and throughout powered flight of the vehicle. The flight safety responsibilities of the Air Force Eastern Test Range and the Kennedy Space Center are summarized. Requirements for flight termination and propellant dispersion are described, and figures are included to pictorially display the Apollo/Saturn IB flight termination propellant dispersion system. Weather minimums are listed, along with the instrumentation available during the S-IB and S-IVB stage powered flights. M.G.J.

N66-30445# Federal Aviation Agency, Atlantic City, N. J. Evaluation Div.

EVALUATION OF LORAN A AND C SIMULATOR Final Report

George H. Quinn Aug. 1965 47 p refs (RD-65-101)

This report contains the results of an evaluation of a Loran A and C Simulator designed to provide signals for dynamic testing of Loran receivers and ancillary equipment. Equipment difficulties discovered during the evaluation are described, and modifications that would improve the Simulator usefulness are suggested. The Simulator output was the equivalent of signals from both Loran-A and Loran-C stations. This output involved selected simulation of the existing East Coast Loran-C triad or two Loran-A station pairs and movement of an aircraft through these Loran signal coverage areas. The simulated signal included variable aircraft speed, fixed altitudes, radio frequency noise, signal strength variations, CW interference signals, and sky waves. Use of the Simulator for dynamic laboratory testing of Loran A and C Receivers is recommended. Author

N66-30518# New York Univ., N. Y. Research Div.

CATALOG OF SIMULATORS FOR TRAINING SPACE FLIGHT PERSONNEL

Hayward Young May 1965 267 p refs (Contract NObsr-89288; Proj. Sete)

(SETE-210/83.1; AD-624227) CFSTI: HC $6.00/MF $1.50

The report is a compilation of short descriptions of ground-based simulators for the training of crew members

or for research into the problems of crew operations and control of manned spacecraft. The simulators described belong to two general classes: (1) fixed or moving base representations of spacecraft crew compartments, and (2) devices used to expose a human subject to space flight related environments such as acceleration and pressure profiles, multi-axis rotations, and reduced gravity states. Some of these simulators provide for determining an astronaut's physiologic or psychologic reactions to phenomena of space travel. Also some are used to develop instrumentation and control systems for manned spacecraft and some are primarily research tools for the study of man's capabilities and requirements for future manned space missions. TAB

N66-30628*# American Machine and Foundry Co., York, Pa. Industrial Products Group.

OPERATION, MAINTENANCE AND DATA, APOLLO DOCKING TEST DEVICE, AMF PART NO. 359-60001 Technical Manual

May 1966 417 p

(Contract NAS9-4300)

(NASA-CR-65418) CFSTI: HC $7.17/MF $2.00 CSCL 14B

This manual contains a detailed description of the systems and individual components of the Apollo Docking Test Device (ADTD). A data section is provided which contains detailed manufacturers' data. Step-by-step procedures are delineated for shipment, handling, installation, interfacing with applicable subsystems, calibration, system checkout of both individual and system combinations, system startup, normal operation, emergency operation, and system shutdown. Repair and replacement procedures for the ADTD are covered, and detailed instructions for storage of the test device are included. H.S.W.

N66-30547# Naval Research Lab., Washington, D. C.

NUMERICAL ANALYSIS OF PIERCE-TYPE ELECTRON GUNS

Richard T. Close 4 Apr. 1966 22 p refs *Its* Sozotron Rept.-1

(NRL-6384; AD-632468) CFSTI: HC $1.00/MF $0.50

Digital-computer programs have been used to analyze four Pierce-type electron guns. The numerical analysis has been very successful in identifying the deficiencies of the Pierce-design method when extrapolated to high perveances. It also has been possible to obtain radial phase-space diagrams for the beams from each of the electron guns studied. From these diagrams and by the use of several other computer programs, an estimate of the transverse energy distribution of the electron beams has been made. It has been found that the major contribution to the random transverse energy must be of nonthermal origin. Author (TAB)

N66-30559# Northwestern Univ., Evanston, Ill. Dept. of Physics.

DESIGN, CONSTRUCTION AND OPERATION OF THE 50 CENTIMETER LIQUID HELIUM BUBBLE CHAMBER Interim Technical Report, 1965-1966

Martin M. Block and Ronald J. Walker Apr. 1966 41 p

(Contract Nonr-1228(21))

(TR-1-66; AD-631930) CFSTI: HC $2.00/MF $0.50

The chamber, whose dimensions are 50×25×30 cu cm, is operated in the magnetic field whose maximum value is approximately 28 kilogauss. The photography is of the dark-field type using straight-thru illumination from a diffusing screen with dark patches. A pair of condensers, located close to the chamber, form images of the dark patches about the 3 camera lenses, which view the chamber with 16 degree stereo. New cameras have been installed which use 35 mm sprocketed film, and these cameras can advance in 0.1 seconds. The chamber has completed a successful run producing 400,000 triads in a 150 MeV/c pion beam at the University of Chicago synchrocyclotron. It requires a crew of three and can be lifted into the beam in an operational condition. The static loss rates from the liquid helium reservoir are around 2 liters/hour and the dynamic loss is about 1 liter per 400 expansions. Author (TAB)

N66-30628# Army Materials Research Agency, Watertown, Mass. Materials Research Div.

A LOW TEMPERATURE NEUTRON IRRADIATION FACILITY FOR STUDIES IN HOT-ATOM CHEMISTRY AND RADIATION DAMAGE STUDIES IN MATERIALS

John R. Hobbs and Charles W. Owens Feb. 1966 25 p refs

(AMRA-TR-66-05; AD-633307) CFSTI: HC $1.00/MF $0.50

A low temperature neutron irradiation facility has been constructed and tested. A description of the apparatus is given and results obtained for the low temperature (−80°C) neutron irradiation of mixed crystals of sodium bromate-sodium chlorate are presented. Author (TAB)

N66-30699# Lockheed-Georgia Co., Marietta.

A FEASIBILITY STUDY FOR AIRDROP DELIVERY SIMULATOR Final Report, 19 Mar. 1965-18 Feb. 1966

Rollo G. Smethers and Fred H. Stokes Ft. Eustis, Va., Army Aviation Materiel Labs., Mar. 1966 132 p refs

(Contract DA-44-177-AMC-260(T))

(ER-8091; USAAVLABS-TR-66-19; AD-633310) CFSTI: HC $4.00/MF $1.00

Investigations, research, and engineering were performed for the purpose of ascertaining the technical feasibility of a laboratory apparatus capable of simulating the response of an airplane to an airdrop. The airplanes considered encompass those currently in use by the U.S. Army as well as those projected into the 1975 time period. Airdrops by means of aft extraction, gravity drop, and forced downward ejection were included in the analysis. Results led to the conclusion that a simulator is feasible but that no specifically applicable apparatus exists which is capable of performing adequate simulations without considerable modification. The results have indicated those parameters in, and as a result of, an airdrop which must be included in a simulation device. It is additionally concluded that the most practical device which best meets the criteria and system requirements established for a simulator is an analog computer. Although a digital computer could perform as a simulator, it would have the disadvantage of not providing direct reading time histories as would an analog device. Finally, it is concluded that the computer available at USAAVLABS is capable of performing adequate simulations. Author (TAB)

N66-30710# ARO, Inc., Arnold Air Force Station, Tenn.

FLOW QUALITY IMPROVEMENT AT MACH 8 IN THE VKF 50-INCH HYPERSONIC WIND TUNNEL B Technical Report, Mar. 1965-Feb. 1966

C. R. Fitch Arnold Eng. Develop. Center, May 1966 23 p refs

(Contract AF 40(600)-1200)

(AEDC-TR-66-82; AD-632828) CFSTI: HC $1.00/MF $0.50

Flow quality within the 50-in. hypersonic tunnel at a nominal Mach number of 8 is discussed. The nozzle and throat were recently remachined to closer tolerances which resulted in

improved test section flow quality. Measurements of the contoured nozzle ordinates and Mach number distributions are presented along with results from method of characteristics solutions of design and actual measured wall contours.
Author (TAB)

N66-30722# ARO, Inc., Arnold Air Force Station, Tenn.
CHECK CALIBRATION OF THE AEDC 16-FT TRANSONIC TUNNEL
J. A. Gunn Arnold Eng. Develop. Center, May 1966 53 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-80; AD-633277) CFSTI: HC $3.00/MF $0.50

Tests were conducted in the Propulsion Wind Tunnel, Transonic (16T) of the Propulsion Wind Tunnel Facility to determine the test section Mach number calibration and Mach number distributions. During the test, Mach number was varied from 0.50 to 1.60, and the wall angle from −1.00 to +1.00 deg, while holding tunnel total pressure at 1000 psfa and tunnel temperature at 120°F. At all Mach numbers the region from Station 1 to Station 20 was considered the test region. The results show that the tunnel calibration is a function of test section wall angle, and that all wall angles in the calibrated Mach number range produced Mach number distributions acceptable for testing. This was the first calibration after the installation of the modified main compressor utilizing fiber glass rotor blades. Author (TAB)

N66-30790*# Union Carbide Corp., Fostoria, Ohio. Carbon Products Div.
CARBON ELECTRODE DEVELOPMENT PROGRAM Final Report, 3 Nov. 1964–3 May 1965
24 May 1965 52 p refs
(Contract NAS9-3699)
(NASA-CR-65411) CFSTI: HC $3.00/MF $0.50 CSCL 14B

Results are presented of a study conducted to improve 16 mm solar positive carbon electrodes. Principal improvements sought were stronger more reliable carbon joints and the elimination or minimization of arc sputtering. The developmental work on the electrode joints, which was designed to increase joint strength and minimize arc sputtering during the burning of joints, is summarized. The study of core formulations, which was conducted to reduce arc sputtering in unjoined electrode sections, is discussed. The manufacture of a limited production run of carbon electrodes having the most improved composition is described. A process flow diagram showing the manufacturing operations involved in making solar arc carbons is included, along with conclusions and recommendations. Results of the study were useful in demonstrating the superiority of the carbon arc as a solar simulating source. The major accomplishments were the development of a completely reliable carbon electrode joint and of carbons which operate with less than 10% of the arc sputtering exhibited by previous 16 mm carbons. R.N.A.

N66-30800*# Wyle Labs., Inc., Huntsville, Ala.
REVIEW OF PROPOSED CONTROL AND INSTRUMENT ROOM FOR BUILDING 4776, MARSHALL SPACE FLIGHT CENTER, HUNTSVILLE, ALABAMA
R. C. Potter May 1966 12 p refs
(Contract NAS8-11312)
(NASA-CR-76332) CFSTI: HC $1.00/MF $0.50 CSCL 14B

This report examines the design of a proposed control and instrument room for the thermo-simulation and cold flow facilities at the Marshall Space Flight Center. Included are discussions of the expected sound pressure levels inside the building, the proposed construction, the estimated noise reduction of the construction technique, a criticism of the proposed construction technique, recommendations, and estimated acoustic levels of the room with the recommended changes.
R.N.A.

N66-30838# Lyon Univ. (France). Institut de Physique Nucleaire.
CIRCULAR SPARK CHAMBERS WITH ELECTRIC LOCALIZATION AT LOW ENERGIES [CHAMBRES A ETINCELLES CIRCULAIRES A LOCALISATION ELECTRIQUE EN BASSES ENERGIES]
Michel Gouanere 15 Jul. 1965 57 p refs In FRENCH; ENGLISH summary
(LYCEN-6523)

Circular spark chambers with electric localization of the spark were investigated. The spark chamber used is described with a survey of its development, principal characteristics, construction, and methods used for the automatic localization of the spark. The studies made on the detection efficiency and the chamber calibration show that the spark formed on the particle trajectory is localized by an electrical procedure and the scattering angle is obtained with a precision of 3°. The particle energy is measured by the number of plates traversed with a precision that can attain 1%. The apparatus can register approximately 1 event per second. The visualization of the trajectories makes possible a constant verification of the operation of the apparatus. Measurements of the efficiency show that the selection of the event by the associated electronics gives information without background. The electric localization leads to a signal proportional to the scattering angle which facilitates the use of the multichannel recorder. There exist several possibilities of transformation such as the utilization of plates of greater thickness, the increase of the number of plates, and the use of two locations for the same semisector. Spark chambers used as polarimeters lead to a time economy for accelerator utilization and makes it possible to use low-intensity beams. With these chambers nuclear reactions with a low cross section can also be studied. NSA

N66-30866# British Aircraft Corp., Stevenage (England). Guided Weapons Div.
SPACE CHAMBER INSTRUMENTATION: THE CHOICE OF PERFORMANCE PARAMETERS
J. L. Blonstein and B. Stockwell Jul. 1964 11 p Presented at 1st Intern. Congr. on Vacuum Tech. in Space Res., Paris, 29 Jun.–4 Jul. 1964
CFSTI: HC $1.00/MF $0.50

After introducing the aim of a space chamber and concluding the differences existing between 'space' in the chamber and real space conditions, the authors deal with temperature measurements on the U.K. 3 satellite (choice of measurement points, use of thermistors) and general performance measurements (the quantities to be telemetered being battery voltage, battery solar array voltage and solar array total current). Individual effects of radiative and conductive heat transfer paths must first be checked to ensure heat flow through the satellite under heat flux and high vacuum conditions. Secondly, the electrical functioning of the satellite must be watched by telemetry link and finally the effects of the space environment on materials, lubricants etc. As conclusion it is found to be necessary to so instrument the test object as to allow full understanding of the thermal exchange processes, rather than to demonstrate actual values or to predict equipment performance. I.M.

N66-30869# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

AN OPTICAL METHOD OF MEASURING FLOW VELOCITY IN AN ARC HEATED WIND TUNNEL

D. J. Buckingham Mar. 1965 29 p refs

(AASU-262) CFSTI: HC $2.00/MF $0.50

Velocity measurements have been made in the flow from the University of Southampton arc heated wind tunnel using an optical method which does not interfere with the flow. The plasma flow was observed through a stationary reference frame with a photomultiplier to determine the amplitude and frequency of the intensity oscillation produced by feeding a small alternating current to the arc. The results of measurements using this technique were compared with those of a Langmuir probe survey and they lie within the uncertainty of the Langmuir probe data. Refinements of the method employed e.g. using high frequency input signal, a condensing lens system and a graded optical filter instead of a wedge would improve the measurement to an accuracy better than 15%. G.S.

N66-30873# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

A WINDTUNNEL INVESTIGATION OF GROUND WIND LOADS ON THE ELDO SATELLITE LAUNCHING VEHICLE

J. W. G. van Nunen 9 Jun. 1965 50 p refs Supersedes FF-14 See N65-23954

(F-249; FF-14) CFSTI: HC $2.00/MF $0.50

The ground-wind loads on a 1:20 scale model of the ELDO satellite launcher were investigated by studying the influence of three different nose cone angles, resp. 40, 60, and 80 degrees, and of a set of third stage antennas. There is a slight increase in drag with Reynolds number. The dynamic coefficients show some scatter as is common in such measurements. The nose cone angle has not much influence on the results. The Reynolds number does not affect the results very much. Removal of the LOX tank pressurization pipe causes a severe vibration of the vehicle at a particular Strouhal number, S= 0.10. Installation of third stage antennas gives somewhat lower bending moments. Author

N66-30875# British Aircraft Corp., Stevenage (England). Guided Weapons Div.

THE SPACE CHAMBER AS A SATELLITE DESIGN TOOL

B. Stockwell [1964] 13 p Presented at 1st Intern. Congr. on Vacuum Tech. in Space Res., Paris, 29 Jun.–4 Jul. 1964

CFSTI: HC $1.00/MF $0.50

To derive a satisfactory thermal design for a satellite, it seems more profitable to define the test environment with simple, rather than realistic, assumptions. The main thermal inputs from the space environment (direct solar radiation, earth reflected solar radiation and direct earth radiation) must be evaluated separately. The relative proportions of these inputs seen by the satellite will be a function of the orbital parameters, the position in the orbit, the detailed characteristics of the various finishes applied to the surface of the device, and also of the actual geometry of the external structure. I.M.

N66-30907# Oak Ridge National Lab., Tenn.

DESIGN OF A HIGH-TEMPERATURE FURNACE (3,000°C)

T. J. Golson (M.S. Thesis) 1 Mar. 1966 98 p refs

(Contract W-7405-ENG-26)

(ORNL-TM-1410) CFSTI: HC $3.00/MF $0.75

The methods of designing and testing a particular high-temperature furnace are given, and some of the more important problems associated with the design for high-temperature equipment are pointed out. Some of the problems discussed are the advantages and disadvantages of both resistance and induction heating, the selection of a gas for use an an inert atmosphere and the possibilities of generating a plasma, the design for a pressure vessel to contain the inert atmosphere, the design for an induction feed-through into the pressure vessel, and establishing a heat balance. The problem of a water leak inside a pressure vessel being operated at a high temperature is also considered. Author (NSA)

N66-30981# Japan Atomic Energy Research Inst., Tokyo.

CONSTRUCTION AND OPERATION OF RADIOLOGICAL MONITORING STATION

Toyohide Ishihara, Satoshi Sasaki, Hiroshi Katagiri, and Masayoshi Tsunokawa 1965 32 p refs In JAPANESE

(JAERI-1098)

Construction progress, equipment, and the radiological monitoring program at JAERI are described. The eight monitoring stations in the system coordinated data on alpha, beta, and gamma activities in the atmosphere, dusts, and from other environmental parameters. Communication between the components and a central receiving station is discussed, and efficiency of the system is evaluated. NSA

N66-31102# New York Univ., N. Y.

A HIGH MACH NUMBER HIGH REYNOLDS NUMBER HYPERSONIC FACILITY Final Report

Antonio Ferri, Victor Zakkay, and Lawrence Carr Wright-Patterson AFB, Ohio, ARL, Oct. 1965 34 p ref

(Contract AF 33(615)-2008)

(ARL-65-218; AD-626983) CFSTI: HC $2.00/MF $0.50

A high Mach number (M=14) high Reynolds number (2×10^7/ft) facility was designed and built. This facility is capable of operating under a stagnation pressure of 30,000 p.s.i. and a stagnation temperature of 2500°R. A four second running time will be available with the present design; however, the possibility of obtaining higher running time may be accomplished by increasing the air storage system. The possibility of increasing the storage air temperature is also presently being investigated. Author (TAB)

N66-31149# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

OPERATIONAL TEST OF MODIFIED T11 ALUMINUM LANDING MAT, ENGLAND AFB, LOUISIANA Final Report

Cecil D. Burns and Gordon L. Carr Jun. 1965 102 p refs

(TR-3-679; AD-620031) Available from Army Engr. Waterways Expt. Station, Vicksburg, Miss.: $0.75

The test was conducted to assess the capability of experimental, modified, T11 extruded-aluminum landing mat as expedient airfield surfacing for use by fighter and cargo aircraft. The mat was placed on a clayey-silt subgrade rated at 4 to 7 CBR in a runway complex 72 ft wide and 1000 ft long with parallel and connecting taxiways 48 ft wide. The system was then subjected to various operations of fighter and cargo aircraft types C-103E, C-123B, F-100, and F-4C. The mat was found suitable for the operation of cargo aircraft and for taxiing of fighter aircraft, but special and careful treatment of drainage, anchorage, and transitions at intersections was found necessary. Author (TAB)

N66-31215*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

DESCRIPTION OF THE DEEP SPACE NETWORK OPERATIONAL CAPABILITIES AS OF JANUARY 1, 1966

W. H. Bayley, R. Stevens, and G. E. Lairmore 1 Jul. 1966 118 p refs Supersedes JPL-TR-32-319

(Contract NAS7-100)

(NASA-CR-76378; JPL-TM-33-255; JPL-TR-32-319)

CFSTI: HC $4.00/MF $0.75 CSCL 14B

The Deep Space Network (DSN) has the capability for two-way communications with, and has the tracking and data-handling equipment to support, unmanned spacecraft traveling approximately 10,000 mi from Earth to interplanetary distances. The main elements of the DSN are the Deep Space Instrumentation Facility (DSIF), the Ground Communications System (GCS) and the Space Flight Operation Facility (SFOF). The DSIF consists of a network of tracking and communication stations strategically situated around the world. The GCS consists of voice, teletype and high speed data circuits between each overseas station, Cape Kennedy and the SFOF. The SFOF contains operations control consoles, status and operations displays, computers and data processing equipment for analysis of spacecraft performance and space science experiments, and communication facilities to control space flight operations. Author

N66-31244# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Porz (West Germany). Institut für Luftstrahlantriebe.

TESTS ON THE TRANSONIC CASCADE TUNNEL. PART 2: ELECTRONIC CONTROL OF THE BOUNDARY-LAYER SUCTION SYSTEM [UNTERSUCHUNGEN AM TRANSONIC-GITTERWINDKANAL. TEIL 2: ELEKTRONISCHE REGELUNG DER GRENZSCHICHTABSAUGUNG]

H. Starken and W. Heilmann May 1966 25 p refs In GERMAN; ENGLISH summary

(DVL-511; DLR-FB-66-32) CFSTI: HC $1.00/MF $0.50

In order to obtain true two-dimensional flow in cascade tunnels, a boundary-layer control is required by means of suction through slots and porous-wall surfaces. Difficulties in adjusting the right test conditions, together with the very expensive running-time of a transonic cascade tunnel led to the development of an electronic control system. The computer program of this system is described, an estimation of the achievable accuracy and an approximate method is given to correct the program on account of the cascade losses. Author

N66-31252# Frankford Arsenal, Philadelphia, Pa. Small Caliber Engineering Directorate.

INVESTIGATION OF THE USEFULNESS OF A FIBERGLASS BARREL Test Report

John K. Gohagan Feb. 1966 14 p

(T66-5-1; AD-632778) CFSTI: HC $1.00/MF $0.50

A fiberglass gun barrel was instrumented for strain measurements and for chamber pressure measurements. X-ray shadowgraphs were taken of each projectile as it traveled down the barrel. High speed movies (black and white and color) were taken observing that half of the barrel toward the muzzle during the time the flame could be expected in that region. The experiment indicated that such a barrel might be an invaluable tool in studying the ballistics of that relatively unknown region with the barrel. Author (TAB)

N66-31341# Southwest Research Inst., San Antonio, Tex. Dept. of Structural Research.

A STUDY OF THE USAF SCHOOL OF AEROSPACE MEDICINE HUMAN CENTRIFUGE, PHASE I Final Report

L. A. Eggleston, R. K. Johnston, and A. J. Pryor 29 Oct. 1965 35 p refs

(Contract AF 41(609)-2715)

(AD-624546) CFSTI: HC $2.00/MF $0.50

A study was made of the fire harzards peculiar to the equipment and operation of the USAF School of Aerospace Medicine Human Centrifuge at Brooks Air Force Base, San Antonio, Texas. This study was based on present Air Force Standards. No major hazards were found, however, recommendations are presented which provide more indepth protection for the centrifuge as it now exists. The major recommendation is the installation of a fire-fog deluge system (with alarm) in the pump room and sub-pit where the storage of combustibles is necessary. Author (TAB)

N66-31360*# Boeing Co., Huntsville, Ala. Launch Systems Branch.

RESEARCH ON PASSIVE INSTRUMENTATION AND STIMULI GENERATION FOR SATURN IB EQUIPMENT CHECKOUT. VOLUME III: APPENDIX A, LABORATORY DATA Final Technical Report, 26 Jun. 1965–31 May 1966

Henry N. Kaushagen and Kenneth L. Skinner 31 May 1966 223 p

(Contract NAS8-20090)

(NASA-CR-76408; D5-13268-3) CFSTI: HC $6.00/MF $1.25 CSCL 22D

This volume constitutes Appendix A to a study on the passive instrumentation and stimuli generation for Saturn S-IB equipment checkout and contains photographs of equipment tested and laboratory setups; curves, graphs, and vendor data in support of laboratory experiments conducted; and information on the operation of special test devices and fixtures used in the study. R.N.A.

N66-31362*# Boeing Co., Huntsville, Ala. Launch Systems Branch.

RESEARCH ON PASSIVE INSTRUMENTATION AND STIMULI GENERATION FOR SATURN IB EQUIPMENT CHECKOUT. VOLUME IV: APPENDIX B, INSTRUMENT UNIT DATA SHEETS Final Technical Report, 26 Jun. 1965–31 May 1966

Henry N. Kaushagen and Kenneth L. Skinner 31 May 1966 355 p ref

(Contract NAS8-20090)

(NASA-CR-76409; D5-13268-4) CFSTI: HC $7.00/MF $1.75 CSCL 22D

Appendix B to a study on passive instrumentation and stimuli generation for Saturn V equipment checkout is presented and consists of data sheets compiled on existing measurement and stimulus channels in the Saturn IB instrument unit. Section 1 contains data sheets for each umbilican connection in the Saturn IB instrument unit used for ground checkout of instrument unit systems via the umbilical connectors. Section 2 contains data sheets for each umbilical connection on the instrument unit used to introduce a stimulus during ground checkout of the instrument unit systems. Section 3 includes data sheets for the measurements required within the instrument unit which are routed to telemetry. R.N.A.

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N66-30023# General Applied Science Labs., Inc., Westbury, N. Y.

INVISCID FLOW FIELD PAST A POINTED CONE AT AN ANGLE OF ATTACK. PART I: ANALYSIS

G. Moretti 15 Dec. 1965 46 p refs

(Contract ARPA SD-149; ARPA Order 396)

(TR-577; AD-632440) CFSTI: HC $2.00/MF $0.50

The conical inviscid flow field past a circular cone at an angle of attack is obtained as the asymptotic stage of a three-dimensional flow. The latter is computed in a spherical frame by means of finite difference techniques associated with a method of characteristics on the shock and body. A brief critical discussion of previous papers on the subject and an analysis of the numerical results are given. Comparison with experiments shows that the applicability of the theory is severely limited by boundary layer effects. Author (TAB)

N66-30088# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STRUCTURE OF SHOCK WAVE WITH MOMENTUM TRANSFER ENERGY WITH RADIATION TAKEN INTO ACCOUNT

V. S. Imshennik and Yu. I. Morozov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 10–38 refs (See N66-30086 17-23)

Solutions are presented to the problem of the front structure of a shock wave with radiation occurring at comparatively small speeds in a substance. A number of simplifying assumptions are introduced. It is pointed out that the complete system of equations consists of equations of state, equations of radiation hydrodynamics, and equations of radiation transfer. For an approximate solution of the problem, the system of equations is reduced to a complex nonlinear differential equation which is investigated by ordinary methods of qualitative analysis. The entire region of the shock wave is divided into three parts; the existence of viscous shock, placed at the origin of the coordinates, is assumed. Angular approximations of the equation of radiation transfer are also formulated. M.G.J.

N66-30089# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE IRREGULAR REFLECTION OF WEAK SHOCK WAVES FROM A RIGID WALL

G. P. Shindyapin *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 39–51 refs (See N66-30086 17-23)

The mode of irregular reflection of weak shock waves is investigated according to the theory of short waves. There is found the particular solution of equations of short waves satisfying boundary conditions of the given problem, including the Mach wave. Examples of calculating the field of speeds of flow, and the reflection are presented. Author

N66-30094# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE STABILITY OF FLOW OF AN IDEAL INCOMPRESSIBLE FLUID IN RECTILINEAR AND ANNULAR CHANNELS

V. M. Kuznetsov and Ye. N. Sher *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 120–135 ref (See N66-30086 17-23)

This paper considers problems of flow stability in a medium with respect to infinitesimally small initial perturbations of the flow region. Of particular interest are a flow occurring on the basis of the inertia of a given initial condition in which the field of velocities is known, and a flow generating from a state of rest under the action of given external forces. In the first type of flow, consideration is given to a case in which the initial moment of time of all elements of the fluid are spread evenly over the entire region. In the second, a flow at constant pressure is considered. It is shown that a rectilinear flow of an ideal incompressible fluid with an initial linear field of velocities is stable with respect to symmetric and unstable with respect to antisymmetric harmonic perturbations of the boundaries. An arbitrary perturbation may be expanded in a Fourier series so that there will be an infinite number of harmonics of any one type. Thus, a rectilinear flow in a given initial field of velocities is unstable. However, this instability is weak because introducing surface tension into the analysis stabilizes the flow. A uniformly accelerated rectilinear flow of an ideal incompressible fluid is unstable. Introducing surface tension and considering elastic forces makes it possible to differentiate stable and unstable harmonics. R.N.A.

N66-30102# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SIMPLIFIED VARIANT OF AN INTEGRAL KINETIC OPERATOR

R. G. Barantsev and B. V. Filippov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 244–249 refs (See N66-30086 17-23)

A simplified form of the integral kinetic operator V of finite time radius of a small band $t\text{-}t_0$ is reported, and some possibilities are discussed for this operator in the solution of kinetic problems both on the level of the distribution function itself, and also in moment approximations. It is pointed out that in a nonstationary problem for t_0 any moment may be taken between the time being considered and the initial; in a stationary problem, the band is essentially spatial. The relationship between the distribution function, expanded into a series in Hermite polynomials, and a sequence of simplified moment kinetic operators is presented. The structure of these operators demonstrates certain characteristic properties of moment equations near a boundary, which are connected with their asymptotic nonuniformity. It is implied that simplified moment operators facilitate the possibility of numerical computations and analytic investigations. R.U.

N66-30103# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SUPERSONIC NONEQUILIBRIUM FLOW OF A GAS NEAR SLENDER BODIES OF REVOLUTION

R. A. Tkalenko *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 250–262 refs (See N66-30086 17-23)

A supersonic flow of gas in which several nonequilibrium chemical reactions near slender bodies of revolution occur simultaneously is examined. By means of Laplace transform a solution is obtained near initial frozen Mach line and an expression is obtained for the potential of the perturbations. A formula is derived for calculating the coefficient of the pressures. Numerical calculations are presented in case of a slender cone. Author

N66-30148# Brown Univ., Providence, R. I. Div. of Engineering.
RADIATING HYPERVELOCITY COUETTE AND BOUNDARY LAYER FLOW IN AIR
Merwin Sibulkin Apr. 1966 28 p refs
(Contract Nonr-562(35))
(Nonr-562(35)/13; AD-631946) CFSTI: HC $2.00/MF $0.50

An analytical solution for high speed Couette flow of a gray gas is given for the situation in which the dominant physical mechanisms are the production of energy by viscous dissipation and its transfer by radiation. The analysis is extended to air for the non-gray, optically thin case including thermal conduction, and numerical results are presented to show the range of validity of the radiation controlled solution. The Couette flow results are then applied to the problem of the hypervelocity, laminar boundary layer on a flat plate in air. An approximate expression for the Planck mean absorption coefficient of air is used, and the results obtained confirm the hypotheses that these boundary layers will be optically thin and radiation controlled. The analysis results in simple expressions for estimating the boundary layer temperature and heat transfer coefficient. Author (TAB)

N66-30174*# Catholic Univ. of America, Washington, D. C.
TAYLOR INSTABILITY IN A STRATIFIED FLOW
Thomas J. Eisler Feb. 1966 25 p refs *Its* Rept.-66-002
(Grant NsG-586)
(NASA-CR-76101) CFSTI: HC $1.00/MF $0.50 CSCL 20D

The effect of a mean flow and density stratification on the instability of a density discontinuity is investigated. The flow is of the jet type between parallel walls with a piecewise linear velocity profile. The stratification is statically stable. The dominant instability occurs for large values of the perturbation wave number. The stratification and flow are generally stabilizing, but the effect of the stratification is found to be destabilizing with respect to small wave numbers. Author

N66-30191# National Research Council of Canada, Ottawa (Ontario).
QUARTERLY BULLETIN OF THE DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT, 1 JANUARY TO 31 MARCH 1966
[1966] 156 p refs
(DME/NAE-1966(1)) CFSTI: HC $5.00/MF $1.00

This report contains three research reports conducted by the Canadian National Research Council's Division of Mechanical Engineering and National Aeronautical Establishment. These reports are concerned with examples of separation in three-dimensional flows, aerodynamic noise in heat exchangers, and damp cold and damp heat. Progress on current projects being conducted on analysis, control systems, engines, gears, flight research, fuels and lubricants, gas dynamics, high and low speed aerodynamics, hydraulics, instruments, low temperature, ships, structures, and unsteady aerodynamics is also described. R.N.A.

N66-30194# Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.
FOUR SIMPLE EXAMPLES OF RELATED HYDRODYNAMIC AND MAGNETOHYDRODYNAMIC FLOWS
Nima Geffen Aug. 1965 34 p refs
(TAE-45) CFSTI: HC $2.00/MF $0.50

This report describes four discontinuous, one-dimensional, non dissipative aligned fields flows of four media: a perfect liquid conductor, an ideal liquid, a perfect gaseous conductor and an ideal gas. The last three cases are well known and will be summarized briefly; the flow of a perfect liquid conductor will be treated in more detail. An analogy among the four cases is shown, and one set of equations for all of them given. Possible extension of this work to two dimensional problems and to the crossed fields case is pointed out. Author

N66-30202# Library of Congress, Washington, D. C. Aerospace Technology Div.
AN APPROXIMATE NUMERICAL METHOD OF CALCULATING A THREE-DIMENSIONAL FLOW IN A STEAM-TURBINE STAGE Surveys of Soviet Scientific and Technical Literature
L. A. Shubenko-Shubin and V. F. Poznakhirev 20 Apr. 1966 18 p refs Transl. into ENGLISH from Teploenerg. (Moscow), no. 11, 1965 p 25–29
(ATD-66-48)

An approximate numerical method of calculating a three-dimensional flow in a steam-turbine stage is studied; the calculation equations used are written in terms of the heat gradient and geometric characteristics of the stage. The author ends the article with a list of 5 conclusions. In part he concludes that to obtain a closed system of differential equations describing the motion of steam or gas through a stage of an axial-flow turbomachine, it is necessary to define additional conditions. The importance of the additional conditions as the main factors determining the design of the stage blades is shown. The original article included 8 references. Author

N66-30247# Pennsylvania State Univ., University Park. Ordnance Research Lab.
FLOW DISTRIBUTIONS IN A CONFINED VISCOUS VORTEX
T. Ginsberg 14 Apr. 1966 66 p refs
(Contract NOw-65-0123-d)
(TM-605-2621-04; AD-632465) CFSTI: MF $0.75

The flow distribution in a viscous vortex, contained in a short cylindrical chamber and driven by injection of fluid through the peripheral wall of the chamber, was investigated experimentally. The radial and axial distributions of the radial and tangential velocities were measured, using a two-dimensional yaw probe to measure flow direction and a pitot probe to measure the velocity head at a point in the flow field. The radial distribution of the static pressure was measured with static pressure taps in the upper end wall of the vortex chamber. It was found that the body of flow away from the end walls behaves approximately like an inviscid fluid in vortex flow, where the static pressure gradient is balanced by the centrifugal force on an element of fluid and where angular momentum is conserved. The axial distribution of radial velocity showed that the boundary layer carried a considerably larger mass flow per unit length of chamber than did the region away from the wall. The reduced centrifugal force on the fluid in the boundary layer, caused by friction at the wall, allowed a large net radial inflow of fluid to the center of the vortex. Author (TAB)

N66-30316*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
FLOW VISUALIZATION EXPERIMENTS WITH SEPARATED SUPERSONIC TURBULENT FLOW
M. V. Lowson Apr. 1966 46 p refs
(Contract NAS8-11308)
(NASA-CR-76126; WR-66-23) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Shadowgraph and surface flow visualization experiments have been performed on a cylinder–flare–cylinder half model mounted on the wall of a seven inch supersonic wind tunnel. The object of the experiments was to define the geometry and flow mechanisms of turbulent supersonic separations. The results generally support earlier analyses of the flow. It has also been shown that the reattachment process is unsteady, and must be expected to lead to substantial fluctuating surface loadings on the flare. The mean reattachment point was found to move up the flare with increase in flare angle, and its height was found to be an approximately constant proportion of the step height. It also appears that the separation geometry on space vehicles will be significantly affected by the presence of the escape tower and surface protuberances. Author

N66-30424# Los Alamos Scientific Lab., N. Mex.
THE TWO-DIMENSIONAL HYDRODYNAMIC HOT SPOT, VOLUME III
Charles L. Mader 5 Apr. 1966 37 p refs
(Contract W-7405-ENG-36)
(LA-3450) CFSTI: HC $2.00/MF $0.50

The shock interactions formed in nitromethane by corners of Plexiglas, aluminum, and gold; the resulting formation of a hot spot; and the buildup to propagating detonation are computed using a high-resolution, Lagrangian, two-dimensional, numerical hydrodynamic code with an Arrhenius rate law and accurate equations of state. Excellent agreement is obtained with the corresponding experimental results. Author (NSA)

N66-30431# Centre National de la Recherche Scientifique, Meudon (France). Laboratoire d'Aerothermique.
USE OF MOLECULAR SONDES. RESPONSE OF THESE SONDES IN A FLOW CLOSE TO FREE MOLECULAR FLOW [MISE EN OEUVRE DE SONDES MOLECULAIRES. REPONSE DE CES SONDES DANS UN ECOULEMENT PROCHE DE L'ECOULEMENT MOLECULAIRE LIBRE]
Pierre Trepaud Jan. 1966 32 p refs In FRENCH
(Rept.-66-1) CFSTI: HC $2.00/MF $0.50

Size problems in making pressure and temperature measurements in a molecular free flow are discussed. A quantitative interpretation of results obtained in an approximate free molecular flow is suggested as a means for resolving this problem. The method of interpretation is described, along with the apparatus used in the measurements; and some sample results are presented in graphic form. Transl. by D.T.

N66-30439# General Electric Co., Philadelphia, Pa. Missile and Space Div.
SPECTRAL THEORY OF TURBULENT MIXING PROCESSES WITH APPLICATIONS TO REACTIONS
C. M. Tchen Dec. 1965 27 p refs
(RC55D66)

The problem of isotropic turbulent mixing of a scalar quantity like contaminant or concentration is investigated on the basis of a generalized eddy viscosity. This paper describes theoretically the form of the spectrum of the scalar quantity at large wave-numbers, taking into account the effects of convection with the fluid, and the effects of molecular viscosity and diffusivity. The method is applied to the case of a concentration change by a simple chemical reaction. Author

N66-30460# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.
EVOLUTIONARY CONDITIONS OF OBLIQUE AND CONICAL SHOCK WAVES AND OF TRANSONIC FLOWS [USLOVIYA EVOLYUTSIONNOSTI KOSYKH I KNOICHESKIKH UDARNYKH VOLN I TRANSZVUKOVYKH TECHENII]
R. V. Polovin 1964 26 p refs In RUSSIAN
(NP-15604)

A review of papers which deal with transonic flow around bodies and with attached oblique and conical shock waves is presented. It is shown that the continuous transition through the sound speed in one-dimensional ordinary hydrodynamics is possible only with increase of Mach number. The starting point in this proof is the evolutionary condition. Then this theorem is extended on two-dimensional flow if sonic line joins the wall in the point where the velocity vector has definite direction. Other demonstrations of this theorem are reviewed. It is then generalized in magnetohydrodynamics. Oblique shock waves attached to the corner are next. Possible bending of the discontinuity line and the impossibility of oblique shock waves, belonging to the strong family, are discussed. It is proven that downstream of the oblique shock wave attached to the corner, the flow is supersonic, the starting point being again the evolutionary condition. It is also proven that oblique detonation waves may exist only in Chapman–Jouget regime, the duct being supposed to have constant cross section. NSA

N66-30481# Rutgers Univ., New Brunswick, N. J. Bureau of Engineering Research.
BASIC STUDIES IN GAS-SOLID SUSPENSION Quarterly Report No. 65-3, Jun.–Aug. 1965
Richard L. Peskin 1 Nov. 1965 12 p
(Contract AT(30-1)-2930)
(TID-22465) CFSTI: HC $1.00/MF $0.50

Results are given of fluid mechanics studies directed primarily at solids density profile investigations, turbulent structure investigations, heat transfer experiments and heat transfer mechanism studies obtained from experimental conclusions, thermal plate-out investigations, studies of diffusion in suspensions, and gas dynamic and thermodynamic cycle studies. NSA

N66-30506# Aerojet-General Corp., Downey, Calif.
INVESTIGATION OF THE COALESCENCE OF WATER DROPS Final Report, 15 Feb. 1965–14 Feb. 1966
G. J. Woffinden Ft. Monmouth, N. J., Army Electron. Command, Apr. 1966 37 p refs
(Contract DA-28-043-AMC-00497(E))
(ECOM-00497-2; AD-632415) CFSTI: HC $2.00/MF $0.50

Experimental techniques have been developed for producing uniform water drops from 25 to 500 microns in diameter. The droplets are formed from a pressure modulated water jet as it passes through a tiny orifice. Orifices with diameters as small as 20 microns have been used. The water pressure is modulated at approximately 160,000 cps for the smallest droplets. The harmonic vibration of the transducer provides a stream of reproducible droplets at controllable intervals. The drop generator was designed for use in studying the coalescence of cloud and fog-size water droplets under various environmental conditions, and high-speed photographic techniques were developed to measure coalescence delay times. Author (TAB)

N66-30533*# TRW Systems, Redondo Beach, Calif.
ONE-DIMENSIONAL TWO-PHASE REACTING GAS NON-EQUILIBRIUM PERFORMANCE PROGRAM Interim Analysis Report
S. S. Cherry and J. R. Kliegel 10 May 1966 319 p refs
(Contract NAS9-4358)
(NASA-CR-65417; TRW-5435-6009-RO-000) CFSTI: HC $7.00/MF $1.75 CSCL 21I

A complete engineering description is presented of a computer program for calculating the inviscid one-dimensional equilibrium, frozen and nonequilibrium nozzle expansion of propellant exhaust mixtures containing carbon, hydrogen, oxygen, nitrogen, fluorine, chlorine, and either aluminum, beryllium, boron or lithium. The program considers the significant gaseous species present in the exhaust mixtures of propellants containing these elements and all gas phase chemical reactions which can occur between the exhaust products. Equations are derived which govern the inviscid, one-dimensional flow of a two phase reacting gas mixture in the form in which they are integrated in the computer program. A brief discussion of the use of both implicit and explicit integration methods to integrate relaxation equations is included, and a detailed engineering description of all the calculations performed in the computer program is provided. H.S.W.

N66-30721# General Electric Co., Schenectady, N. Y. Research Lab.
DENSITY INDUCTION TIMES BEHIND SHOCK WAVES IN VERY LEAN MIXTURES OF D_2, H_2, C_2H_2, AND C_2H_4 WITH O_2 Interim Technical Report
D. R. White Wright-Patterson AFB, Ohio, ARL, Dec. 1965 37 p refs *Its* Rept.-65-RL-3943C
(Contract AF 33(657)-7945)
(ARL-65-274; AD-632755) CFSTI: HC $2.00/MF $0.50

The induction time for shock wave-induced exothermic reaction in lean O_2–D_2, O_2–H_2, O_2–C_2H_2, and O_2–C_2H_4 mixtures has been measured in the constant area shock tube using optical interferometry. For fuel/oxygen ratios of a few percent and for $1100°<T<2200°K$, the gas time from the shock to the first decrease in density is given in moles/liter, seconds, and degrees K. All fuels show essentially the same activation energy (~17.3 kcal/mole); and with respect to H_2, the induction times for D_2, C_2H_2, and C_2H_4 are about 1.5, 0.5, and 0.4, respectively. The more nearly stoichiometric mixtures show induction times inversely proportional to the geometric mean reactant concentration, and the dependence on the fuel concentration increases with decreasing fuel/O_2 ratio, the dependence on $[O_2]$ vanishing for the leanest O_2–C_2H_4 mixtures. The vibrationally relaxed but unreacted density is always attained prior to exothermic reaction, and changing the relaxation time with respect to the induction time has no effect on the latter within the data scatter. Author (TAB)

N66-30725# National Engineering Science Co., Pasadena, Calif.
ON THE BREAKING OF WAVES ARRIVING AT AN ANGLE TO THE SHORE Final Report
Bernard J. Le Mehaute and Robert C. Y. Koh 15 Feb. 1966 86 p refs
(Contract Nonr-4177(00))
(SN-134-10; AD-632851) CFSTI: HC $3.00/MF $0.75

By using the method of conservation of energy flux between wave orthogonals, the breaking wave characteristics are obtained for waves traveling obliquely to the bottom contours of a straight shoreline. The results of the calculations are presented in the form of nomographs by using the linear and third order irrotational gravity wave theories. Three different breaking criteria are used in these calculations. In particular, a new breaking criterion is proposed for waves breaking on a gentle slope. Some calculations are also performed at the fifth order of approximation and the results compared with the linear and third order cases. Author (TAB)

N66-30728# Ballistic Research Labs., Aberdeen Proving Ground, Md. Terminal Ballistics Lab.
OVERPRESSURES AND DURATIONS OF SHOCK WAVES EMERGING FROM OPEN-ENDED SHOCK TUBES
Brian P. Bertrand and William T. Matthews Nov. 1965 45 p refs
(BRL-MR-1724; AD-633161) CFSTI: HC $2.00/MF $0.50

The field wave overpressures and durations resulting from shock waves emerging from open-ended shock tubes have been measured. An equation has been developed from the measured data that relates the field overpressures (below 0.1 psi) resulting from a given shock tube pressure, to the tube diameter and distance from the tube exit. An equation has also been developed from the same data that relates the duration of the field wave (below 0.1 psi) to the exit areas of the tubes for a given shock tube pressure. Predictions of field overpressure and duration have been made for an eight foot diameter shock tube firing a 27 psi shock wave. Author (TAB)

N66-30736# Naval Ordnance Lab., White Oak, Md.
LAMINAR AND TURBULENT BOUNDARY LAYERS ON SLIGHTLY-BLUNTED CONES AT HYPERSONIC SPEEDS Final Report
R. E. Wilson 21 Mar. 1966 35 p refs
(NOLTR-66-54; AD-632714) CFSTI: HC $2.00/MF $0.50

A momentum-integral method for calculating the boundary-layer growth on slightly-blunted cones has been given in a previous paper by the writer. The method, which was applied to cones with fully laminar flow, is extended in the present paper to turbulent flow. In addition: (1) transition data on cones at hypersonic speeds are examined to show the great effect of slight nose blunting on interpretation of the results, (2) agreement between measured and calculated cone drag coefficients for fully laminar flow is demonstrated, and (3) turbulent friction and boundary-layer thickness calculations are shown to agree with the limited amount of ballistics range data which are available. Author (TAB)

N66-30874# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
A STUDY OF THE OSCILLATING LAMINAR SEPARATED FLOW AHEAD OF A FORWARD FACING STEP OSCILLATING TRANSVERSELY TO A HYPERSONIC FREE STREAM
R. A. East and P. R. Wilkinson Jan. 1966 31 p refs Presented at AGARD Specialists Meeting on Separated Flows, Rhode-St.-Genese, Belgium, 10–13 May 1966
(AASU-2637) CFSTI: HC $2.00/MF $0.50

The experimental results of this paper demonstrate that the separated flow region does not behave in a quasi-steady manner and that appreciable phase differences exist between the movement of the separation point and that of the step. The experiments were performed in a hypersonic gun tunnel at Mach numbers in the range 8.4 less than M less than 12.5 and unit Reynolds numbers of 10^5 to 10^7 per foot. The theoretical work suggests certain parameters upon which the characteristics of this phenomenon depend. These are examined in the light of the experimental results. Author

N66-30882# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).

PRESSURE MEASUREMENTS ON A 1/40th SCALE MODEL OF THE ELDO SATELLITE LAUNCHING VEHICLE IN THE NLR SUBSONIC AND TRANSONIC WIND TUNNEL H.S.T.

B. M. Spee and P. L. van Amerom 22 May 1964 317 p refs (T-91) CFSTI: HC $7.00/MF $1.75

The vehicle was equipped with a 30 degree half angle nose cone and the measurements were performed at Mach numbers from 0.35 to 1.3. Influence of different radii of the shoulder and of different angles of incidence was investigated. Local normal-force, total normal-force, pitching moment and pressure drag coefficients were found to be in good agreement with earlier tests. Negative pressure coefficient peaks were found to vary with Mach number and incidence. Examination of the results suggests the presence of flow separation at the satellite fairing shoulder at high subsonic Mach numbers for both configurations, depending on incidence. Author

N66-30900# Colorado Univ., Boulder. Engineering Research Center.

FLOW CALIBRATION OF THE LONG JOHN MANIFOLDED ORIFICE ASSEMBLY WITH AIR Final Report

Joel Lerich Feb. 1966 162 p refs
(Contract W-7405-ENG-48)
(UCRL-13202) CFSTI: HC $5.00/MF $1.00

The repeatability and calibration potential of available gas flowmeters were investigated. The critical nozzle was chosen as a transfer standard based on its simplicity, inherent repeatability, and ease of usage. An investigation into the performance of various orifice tap configurations was performed. The corner tap was decided to be best suited for use in the Long John Orifice assembly because of its stability of signal. A primary calibration device was designed and fabricated to calibrate the transfer standard. A set of critical nozzles was obtained and calibrated with the primary calibration device. Additional tests provided cross-comparisons with other flowmeters. These auxiliary data were useful in the analysis of the primary data on the transfer standards. Approximately three thousand calibration points were obtained on the Long John Orifice assembly using air as a test media at flow rates ranging from 0.0004 to 6.4 lbs/sec. NSA

N66-30901# United Kingdom Atomic Energy Authority, Culham (England).

A MONTE CARLO COMPUTER PROGRAMME FOR ANALYSIS OF MOLECULAR GAS FLOW

J. N. Chubb Dec. 1965 48 p refs
(CLM-R-54) HMSO: 6s

Molecular gas flows cannot be studied analytically within vacuum systems in which a pumping orifice or surface forms an appreciable fraction of the total internal surface area of the system. Such systems may be studied successfully by the Monte Carlo method in which an average picture of the molecular flow is by mathematical simulation of the course of a large number of individual molecular histories within a mathematical representation of the vacuum system. A description is given of a Monte Carlo computer program which was developed for analysis of molecular gas flow, with emphasis placed on the ease of use and on the practical application of the information which may be extracted. The application of this program is illustrated by examples of calculations which were performed on experimental apparatus for the measurement of sticking coefficients, and on test domes for measuring the performance of diffusion pumps. Author (NSA)

N66-31083# Dartmouth Coll., Hanover, N. H. Thayer School of Engineering.

TWO-PHASE FLOW AND BOILING HEAT TRANSFER Final Report

G. B. Wallis Feb. 1966 202 p refs
(Contract AT(30-1)-3114)
(NYO-3114-14; EURAEC-1605) CFSTI: HC $6.00/MF $1.25

An investigation was made of the basic properties of two-phase flows and their relevance to engineering design. Certain "flow regimes" were chosen for study and an adequate analysis of the principal dynamic processes was sought. The following flow regimes were discussed in some detail: bubbly flow, slug flow, the transition from slug flow to annular flow in a vertical pipe, annular flow, horizontal flow, vertical flow, and droplet entrainment from a liquid film. Author

N66-31096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AERODYNAMICS AND HEAT TRANSFER OF A FLAT TURBULENT STREAM FLOWING ALONG A FLAT SURFACE

A. L. Kuznetsov and A. V. Sudarev 17 Dec. 1965 17 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), no. 6, 1964 p 8–11
(FTD-TT-65-1030/1+2+4; AD-625056) CFSTI: HC $1.00/MF $0.50

An approximate theoretical solution is given for a stream flowing along a flat plate. The aerodynamics and heat transfer are considered for the initial and transitional sections of flow. The solution is shown to be applicable to combustion chambers and elements of gas turbine installations where turbulent semi-limited jet flows are encountered. C.T.C.

N66-31098# Cincinnati Univ., Ohio.

ASYMPTOTIC METHOD OF SOLUTION OF THE FROZEN DISSOCIATED LAMINAR BOUNDARY LAYER FLOW OVER A FLAT PLATE SURFACE WITH ARBITRARILY DISTRIBUTED CATALYCITY Interim Technical Report, Jun. 1964–Jun. 1965

Ting Y. Li and Phillip S. Kirk Wright-Patterson AFB, Ohio, ARL, Dec. 1965 34 p refs
(Contract AF 33(616)-8453)
(ARL-65-243; AD-628694) CFSTI: HC $2.00/MF $0.50

Meksyn's method of solution of laminar boundary layers is extended to deal with a typical problem of a binary boundary layer with non-similar solution. The present paper deals with the asymptotic method of solution of the frozen dissociated laminar boundary layer flow over a flat plate surface with arbitrarily distributed catalycity. A closed form solution is obtained and has been compared with existing data due to other investigators. Results of the comparison show that the present results are of adequate accuracy. The attractiveness of the present method is in the simplicity of the analysis. Author (TAB)

N66-31107# Heliodyne Corp., Los Angeles, Calif.

REENTRY PHYSICS RESEARCH Semiannual Technical Summary Report, 13 Jun.–12 Dec. 1965

Dec. 1965 13 p refs
(Contract DA-01-021-AMC-12727(Z); Proj. Defender)
(AD-625887) CFSTI: HC $1.00/MF $0.50

Investigations were conducted in the areas of mixing and chemical reactions in turbulent wakes; analyses of optical deflections through a turbulent wake; shock structure in a non-reacting, ablating dust-laden gas; and shock tube

studies of the optical and chemical properties of teflon in argon, nitrogen and air. The individual research topics are described in the following pages in the form of abstracts from completed reports, or progress reports on continuing activities. Author (TAB)

N66-31136# Compagnie de Recherches et d'Etudes Aeronautiques, Paris (France).
CONTROL OF CIRCULATION AROUND A CIRCULAR CYLINDER
Jean Brocard 20 Jan. 1964 38 p ref
(Contract AF 61(052)-653)
(AD-631754) CFSTI: HC $2.00/MF $0.50

The completion of research on circulation control to determine the optimum combination of suction and blowing with respect to the lift/drag ratio and the power required is reported. Coefficients for various combinations from pure suction to pure blowing over the surface are presented. Details are given on the wind tunnel test facility, the cylinder, and the test program. It was found that blowing on a 36° compartment furnished the best results. Most of the jet in this case is directed downstream of the air current, decreasing the drag. N.E.N.

N66-31166# Politecnico di Torino (Italy). Istituto di Meccanica Applicata.
ON THE TURBULENCE DEVELOPMENT IN THE BOUNDARY LAYER WITH PRESSURE GRADIENT Technical Note No. 30
Ennio Mattioli Jul. 1965 41 p refs *Its* Sci. Rept.-6
(Grant AF-EOAR-63-98)
(AFOSR-65-2187; AD-625361)

The research includes: (1) a theoretical-experimental research on working of the pressure gradient wind tunnel (which was especially built for this purpose); (2) speed and turbulence intensity measurements in the boundary layer of a flat smooth plate, with different values of pressure gradient, or in the presence of turbulence in the undisturbed stream; (3) a study of the variations of displacement thickness, momentum loss thickness, shape parameter; (4) speed fluctuation recording within the boundary layer during the transition; (5) control of the whole phenomenon by means of the china-clay method. Conclusions are drawn about the disturbed boundary, origin and nature of the transition, modification of the shape parameter. Author (TAB)

N66-31184# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION OF A LAMINAR BOUNDARY LAYER FOR SUBLIMABLE SURFACE
V. V. Shchennikov 19 Nov. 1965 26 p refs Transl. into ENGLISH from Zh. Vychislitel'noi Mat. Fiz. (Moscow), v. 1, no. 5, 1961 p 869–883
(FTD-MT-65-10; AD-624761) CFSTI: HC $2.00/MF $0.50

The work is devoted to the problem of the calculation of a laminar boundary layer near sublimable axially symmetric blunt body, moving at a great supersonic speed. There are obtained equations and boundary conditions of the problem. The high temperature in boundary layer causes the presence of chemical reactions. The method of calculating the stationary flow near the critical point of a blunt axially symmetric sublimable body, whose temperature and pressure satisfy either the condition of phase transition, or condition of evaporation is presented. The assumption as to the stationarity of the flow is justified by the following considerations. It is possible to present a special body, which in sublimating repeats its own shape. On the other hand, for any smooth body this assumption has substantiation when the speed of the sublimation is much less than the speed of the oncoming flow. The obtained numerical results for the case of a body consisting of graphite flowed around by oxygen where the chemical reactions occurring in the boundary layer are assumed to be equilibrium. Author (TAB)

N66-31273# Pennsylvania State Univ., University Park. Dept. of Aeronautical Engineering.
THEORETICAL INVESTIGATION OF TURBULENT FLOW OF NON-NEWTONIAN MEDIA Annual Summary Report, 1 Sep. 1964–30 Jun. 1965
John L. Lumley and Kirtan Singh 10 Jun. 1965 36 p refs
(Contract Nonr-656(33))
(AD-616647) CFSTI: HC $2.00/MF $0.50

Problems related to studying the homogeneous, isotropic turbulent flow of certain non-Newtonian media are examined. The initial value problem for a second order fluid is considered, and equations are derived to give the rate of change of time with time of second order velocity correlations for non-Newtonian fluids. Some details are also given on the use of the Maxwell model, in place of the second order fluid, for retaining non-Newtonian behavior when quadratic terms are neglected in the limit. The nearly inertial subrange problem is discussed, along with an approximation method for the turbulence problem in a second order fluid. Data are also included on a molecular viscoelasticity interpretation of the wall shear stress threshold in the Toms effect. Various hypotheses are discussed, and experimental results are given. M.G.J.

N66-31293# Hydronautics, Inc., Laurel, Md.
A COMPARISON BETWEEN THEORETICAL AND MEASURED WAVES ABOVE A SUBMERGED RANKINE BODY
C. C. Hsu and B. Yim Feb. 1966 26 p refs
(Contract Nonr-3688(00))
(TR-231-10; AD-632718) CFSTI: HC $1.00/MF $0.50

A comparison is made of theoretical and measured wave patterns produced by a submerged Rankine body (7:1) moving at constant speed. The measurements were made for a range of Froude numbers, but for a single depth/length ratio (1:3). Calculations were made for both the far and near fields. The former utilize the stationary phase approximation and the latter involve numerical integrations and include the local disturbance. In general, the agreement between theory and experiment is as good as the agreement between measurements taken at the same Froude number but for two different body lengths (4.5 and 9.0 feet). It is concluded from these tests that first-order wave theory predicts the shape and amplitude of the waves produced by a fully submerged body with sufficient accuracy for almost all practical purposes. Author (TAB)

N66-31312# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
NUMERICAL STUDIES IN GAS DYNAMICS Final Scientific Report, 14 Mar. 1965–13 Mar. 1966
Graeme A. Bird 16 Mar. 1966 7 p refs
(Grant AF-AFOSR-915-65)
(AFOSR-66-0857; AD-632818) CFSTI: HC $1.00/MF $0.50

The report describes the work that has been carried out on the following topics: (a) The application of a Monte Carlo simulation technique to additional problems in rarefied

gas dynamics. In particular, an unfinished study of the breakdown of continuum flow in steady expansions, (b) The numerical simulation of the motion of a test particle in an ionized gas, (c) An exact analytical solution for the compression of a highly rarefied plasma between converging magnetic mirrors, (d) The preliminary study of the theoretical performance of a multi-stage hypervelocity launcher.
Author (TAB)

N66-31326*# Toronto Univ., (Ontario). Inst. for Aerospace Studies.
REPORT ON THE FOURTH INTERNATIONAL SYMPOSIUM ON RAREFIED GAS DYNAMICS
G. N. Patterson [1964] 67 p Symp. held at Toronto, Canada, 14–17 Jul. 1964 Sponsored by AF Office of Sci. Res. and NASA
(Grant Nonr-(G)-00068-64)
(NASA-CR-76458; AD-632897) CFSTI: HC $3.00/MF $0.75 CSCL 01A

The report contains reviews prepared during the meeting of papers in the following areas: transition flow, experimental techniques and apparatus, surface interactions, kinetic theory, molecular beams, internal flow, and rarefied plasmas and shock structure. TAB

N66-31329# Oceanics, Inc., Plainview, N. Y.
THEORETICAL CONSIDERATIONS OF THE STABILITY OF PULSATILE FLOW IN TUBES Final Technical Report, Oct. 1964–Mar. 1966
Theodore R. Goodman May 1966 25 p refs
(Contract Nonr-4432(00))
(Rept.-66-27; AD-633290) CFSTI: HC $1.00/MF $0.50

Hydrodynamic stability theory is applied to oscillatory flow in a pipe. A criterion for stability is established, and an attempt is made to solve the resulting eigenvalue problem using an iterative numerical method. Because of nonconvergence the question of stability remains unresolved.
Author (TAB)

N66-31345# General Electric Co., Philadelphia, Pa. Missile and Space Div.
LAMINAR INCOMPRESSIBLE LEADING AND TRAILING EDGE FLOWS AND THE NEAR WAKE REAR STAGNATION POINT
S. Weinbaum May 1966 47 p refs Presented at the AGARD Specialists' Meeting on "Separated Flows", Rhode-Saint-Genese, Belg., 10 May 1966 Supersedes R66SD18
(Contract AF 04(694)-897)
(R66SD25; R66SD18; AD-632542) CFSTI: HC $3.00/MF $0.75

The paper investigates the behavior of a viscous incompressible fluid in the vicinity of various two-dimensional separation and stagnation points. Locally valid series solutions to the Navier–Stokes vorticity equation are developed to study the pressure-viscous force balance in the neighborhood of the singularity and the transition to the flow region where inertial effects are important. Solutions are presented for an arbitrary symmetric leading or trailing edge except for an arbitrary constant that depends on the wall shear. The solution for the near wake rear stagnation point shows that the wake cannot close in an arbitrary manner, but that the asymptotic direction of the dividing streamline prior to stagnation is a single valued function of the ratio of the velocity on the dividing streamline to that on the wake centerline. The blunt based trailing edge is examined from two viewpoints. One is analogous to Goldstein's development for the flat plate trailing edge in that it assumes a Blasius profile at separation. The other is a parametric study to explore the effect of upstream influence on the point of separation and the initial shape of the dividing streamline.
Author (TAB)

N66-31352*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
CAVITATION SIMILARITY CONSIDERATIONS BASED ON MEASURED PRESSURE AND TEMPERATURE DEPRESSIONS IN CAVITATED REGIONS OF FREON 114
Thomas F. Gelder, Robert S. Ruggeri, and Royce D. Moore Washington, NASA, Jul. 1966 37 p refs
(NASA-TN-D-3509) CFSTI: HC $2.00/MF $0.50 CSCL 20D

Well-developed cavitation of Freon 114 (dichlorotetrafluoroethane) was induced on the walls of a venturi in a closed-return hydrodynamic tunnel. The venturi contained a convergent section to provide the transition from a 1.743-inch-diameter approach section to a 1.377-inch-diameter throat section. The approach velocity was varied from 19 to 44 feet per second and the bulk-liquid temperature from 5° to 80° F. Measured pressures and temperatures within the cavitated regions were in thermodynamic equilibrium at values less than free-stream (approach section) values of bulk-liquid temperature and its corresponding vapor pressure. At constant bulk-liquid temperature, maximum and average cavity pressure depressions below bulk vapor pressure increased almost directly with increased approach velocity. For a fixed velocity, the cavity pressure depression at 78°F was about 4.5 times that at 28°F. The maximum measured cavity-pressure depression at 78.4°F was 10.2 feet of liquid Freon 114. Similarity parameters for cavitation were developed by using minimum cavity pressure as a reference rather than bulk vapor pressure. Trends in the Freon 114 data and comparisons with previous measurements within cavities in water, nitrogen, and ethylene glycol in the same venturi are in reasonable agreement with those predicted from simple theoretical analyses. Author

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N66-29988# Emmanuel Coll., Boston, Mass. Research Language Center.
A NOTE ON THE NON-UNIQUENESS OF THE UMKEHR METHOD B
Li-bin Li, Xin-yu Huang, and Jun Li Bedford, Mass. AFCRL Mar. 1966 12 p refs Transl. into ENGLISH from Acta Geophys. Sinica (China), v. 13, no. 1, 1964 p 20–23
(Contract AF 19(628)-5073)
(EMM-65-40; AD-632408) CFSTI: HC $1.00/MF $0.50

The Umkehr method B is used to determine the fine structure of the vertical distribution of atmospheric ozone. Essentially, the curve representing the vertical ozone distribution is continuous and smooth. In the method B, a block distribution diagram is used to replace this continuous curve. An optimum block distribution diagram is then obtained by the method of successive approximation. Based on the trend of variation of the optimum block diagram, the smooth curve connecting the areas may be considered approximately as the curve for the vertical ozone distribution. Author (TAB)

N66-30015# Stanford Univ., Calif. Radioscience Lab.
A STUDY OF WAVE PARTICLE INTERACTIONS IN THE MAGNETOSPHERE AND A COMPLEMENTARY STUDY OF THE PROPAGATION CHARACTERISTICS OF WHISTLERS AND RELATED PHENOMENA Final Report, 1 Oct. 1964–30 Sep. 1965
R. A. Helliwell Mar. 1966 13 p refs
(Grant AF-AFOSR-783-65)
(AFOSR-66-0715; AD-632266) CFSTI: HC $1.00/MF $0.50

Three principal areas of investigation are reviewed: (1) propagation and detection studies at vlf; (2) basic studies of the thermal plasma in the magnetosphere; and (3) wave particle interactions. In most cases only a brief description is given, particularly where details are available in reports and publications listed in the attached bibliography. In addition to the bibliography, there is included a list of papers presented at technical meetings and symposiums. Author (TAB)

N66-30024# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE POSSIBILITY OF MEASURING ATOMIC OXYGEN AT THE HEIGHT OF 100–150 KM BY THE HEAT TRADUCER METHOD
S. P. Perov and A. F. Chizhov 30 Mar. 1966 17 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 56, 1964 p 121–127
(FTD-TT-65-1416/1+2+4; TT-66-61208; AD-632315) CFSTI: HC $1.00/MF $0.50

In the article there is shown the principle of the possibility of measuring the concentration of atomic oxygen in the atmosphere at the height of 100–150 km by the method of the heat traducer, the sensitive element of which is heated with the recombination of the atoms of oxygen on its surface (heat effect of recombination). Author (TAB)

N66-30033# Weapons Research Establishment, Salisbury (Australia).
BASIC ATMOSPHERIC PARAMETERS AS MEASURED BY FOUR FALLING SPHERE EXPERIMENTS AT WOOMERA, MAY–AUGUST, 1965
P. H. O. Pearson Mar. 1966 39 p refs
(WRE-PAO-113) CFSTI: HC $2.00/MF $0.50

Four falling sphere experiments were conducted at Woomera from May to August, 1965. These results are the first from the second year of firings in a continuing series to measure the seasonal variation of density, temperature, pressure and winds shortly after sunset. Author

N66-30095# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SILTING OF BOTTOM ZONE OF A WELL
N. N. Verigin *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 136–148 refs (See N66-30086 17-23)

In pumping out water from wells and their bottom zone under the influence of the change in pressure there occurs a precipitating out of the water and the combining with the ground of certain suspended and dissolved substances (suspended mineral particles, colloids of iron hydroxide, dissolved in the water of carbonates etc.). This phenomenon causes a silting of the bottom zone, a decrease of its permeability and a lowering of the discharge of the wells. The formulation of a nonlinear boundary value problem on the silting of the bottom zone and its solution for fixed and flexible infiltration conditions is presented. Author

N66-30182*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE EQUATORIAL ELLIPTICITY OF THE EARTH FROM TWO MONTHS OF SYNCOM II DRIFT OVER THE CENTRAL PACIFIC
C. A. Wagner Washington, NASA, Jul. 1966 44 p refs
(NASA-TN-D-3315) CFSTI: HC $2.00/MF $0.50 CSCL 08N

This is the second in a series of reports on the use of tracking information from Syncom II satellite to define the longitude-dependent gravity field of the earth. This tracking information shows that Syncom II drifted freely in the gravity fields of the earth, sun, and moon from 25 April to 3 July 1964. In early May, the ascending equator crossing of the orbit, as determined from radar range and range-rate tracking, was at 121° west, with a westward drift rate of 0.81 degrees/day. During the following two-month period, this drift rate decreased steadily until late in June when, with the ascending equator crossing at 161° west, the westward drift rate was 0.75 degrees/day. This decelerating drift rate is entirely consistant with the magnitude and phase angle of the equatorial ellipticity of the earth, as previously determined by this author. These ellipticity constants were responsible for the accelerated drift of this satellite in the longitudes from 55° to 64° west. By utilizing the first (energy) integral of the drift motion of a 24-hour satellite in a second-order longitude-dependent earth gravity field, the drift of Syncom II over the Central Pacific during the two months in question was seen to be sensitive to parameters of the earth's equatorial ellipticity: $J_{22}=-(1.71 \pm 0.22)\times 10^{-6}$, which corresponds to a difference in the major and minor equatorial axes of the earth of $a_0-b_0=214\pm 28$ feet, and $\lambda_{22}=-(17.1 \pm 4.9)$ degrees, which gives the longitude of the major equatorial axis with respect to Greenwich. Author

N66-30199# Joint Publications Research Service, Washington, D. C.
PHOTOGRAPHY IN AIRBORNE GEOPHYSICAL SURVEYING
I. D. Boshnyakovich and Yu. S. Glebovskiy 8 Jul. 1966 92 p Transl. into ENGLISH from the book "Fotoprivyazka Aerogeofizicheskikh Marshrutov i Anomaliy" Moscow, 1963 p 3–5, 17–33, 71–113
(JPRS-36383; TT-66-32815) CFSTI: HC $3.00

An introduction is presented to the theory and practice of photographic bridging used in aerial geophysical surveying. Included are discussions of aerial geophysical methods of geological exploration, the methodological bases of aerial geophysical surveys, horizontal bridging and its accuracy, visual horizontal bridging, and the advantages and shortcomings of photographic bridging. Also examined are the selection of landmarks, photographic bridging of various types of traverses for an aerial geophysical survey, the methodology of transferring the principal points of aerial photographs from photographic tracking of aerial geophysical operations onto report maps, features of photographic bridging at altitudes less than 100 meters, and special cases of photographic bridging. R.N.A.

N66-30252# Johannes-Gutenberg-Universitat, Mainz (West Germany). Meteorologisch-Geophysikalisches Institut.
RESEARCH ON ATMOSPHERIC OPTICAL RADIATION TRANSMISSION Scientific Report No. 4
K. Bullrich, E. de Bary, K. Danzer, R. Eiden, and G. Haenel Jan. 1966 140 p refs
(Contract AF 61(052)-595)
(AFCRL-66-212; AD-632343) CFSTI: HC $4.00/MF $1.00

Part A: Influence of the natural atmospheric particles with noncontinuous size distribution on light scattering processes. Part B: Analyzing method of measured light scattering of a unit volume of turbid air. Part C: Elliptical polarized light of a unit volume of turbid air. Part D: Measurements of the sun's aureole intensity. Part E: Refractive index of atmospheric dust particles. Author (TAB)

N66-30255*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EQUATORIAL ELLIPTICITY OF THE EARTH AS SEEN FROM FOUR MONTHS OF SYNCOM II DRIFT OVER THE WESTERN PACIFIC

C. A. Wagner Washington, NASA, Jul. 1966 32 p refs

(NASA-TN-D-3313) CFSTI: HC $2.00/MF $0.50 CSCL 08E

Tracking information from Syncom II satellite is used to define the longitude-dependent gravity field of the earth. This set of orbit data shows that the westward drift of Syncom II decelerated from 0.480 degrees/day at a nodal longitude of −174.35° in early July 1964, to 0.446 degrees/day at a longitude of 159.53° in late August 1964. Further westward drift of the satellite resulted in an acceleration of the westward drift rate to 0.501 degrees/day when Syncom II reached a mean longitude of 134.22° in early November 1964. On the assumption that this four-month drift of Syncom II was sensitive to only second-order longitude-dependent earth gravity (associated with the ellipticity of the earth's equator), as well as sun, moon and ordinary earth zonal gravity forces, the magnitude and orientation of such equatorial ellipticity is calculated as $J_{22}=-(1.86 \pm .14)\times 10^{-6}$, which corresponds to a difference in major and minor equatorial radii of the earth of $a_0-b_0=234 \pm 18$ ft, and $\lambda_{22}=-(16.6 \pm 2.9)°$, which locates the longitude position of the major equatorial axis with respect to Greenwich. Author

N66-30278# Army Foreign Science and Technology Center, Washington, D. C.

PHOTOELECTRIC DETERMINATION OF GEODETIC AZIMUTH BY DIRECT METHOD. CHECKING UP OF UNIVERSAL DEVICES SPR-2, SD-1, SD-1M

N. A. Belyayev, M. V. Abramova, and O. V. Portnova Jan. 1965 24 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 9, 1964 p 13–17, 45–54

(FSTC-381-T64-88; AD-475916)

CONTENTS:

1. PHOTOELECTRIC DETERMINATION OF GEODETIC AZIMUTH BY DIRECT METHOD N. A. Belyayev p 1–7 (See N66-30279 17-13)

2. CHECKING UP OF UNIVERSAL DEVICES SPR-2, SD-1, SD-1M M. V. Abramova and O. V. Portnova p 8–20 (See N66-30280 17-14)

N66-30279# Army Foreign Science and Technology Center, Washington, D. C.

PHOTOELECTRIC DETERMINATION OF GEODETIC AZIMUTH BY DIRECT METHOD

In its Photoelec. Determination of Geodetic Azimuth by Direct Method. Checking Up of Universal Devices SPR-2, SD-1, SD-1M Jan. 1965 p 1–7 (See N66-30278 17-13)

Expressions are presented for the geodetic azimuth incorporating the error incurred by using photoelectric recording. Photoelectric determinations of the geodetic azimuth of the collimator by the direct method were performed, and determinations of a geodetic azimuth at a first class triangulation point were made. Pairs of stars brighter than 5.5 magnitude were chosen on different sides of zenith and at a range of azimuth distances from 30° to 70°. The computational formulas are given. The error in deriving the average result was calculated to be ±0".13 for the azimuth of the collimator, and ±0".2 for the azimuth of the first class triangulation. Determinations were also made of the geodetic azimuth with photoelectric registration of the meridian transits, with the error in the average result ±0".42. N.E.N.

N66-30297*# California Univ., Berkeley. Space Sciences Lab.

THE ORGANIC GEOCHEMISTRY OF ANCIENT SEDIMENTS, PART II

R. B. Johns, T. Belsky, E. D. Mc Carthy, A. L. Burlingame, Pat Haug et al 15 Feb. 1966 116 p refs Submitted for Publication *Its* Ser. No. 7, Issue No. 8

(Grant NsG-101-61)

(NASA-CR-70789) CFSTI: HC $3.00/MF $0.75 CSCL 08D

Evidence is discussed for the presence of life processes as early as 2.7 billion+ years ago, based on chemical analysis of hydrocarbon constituents of a representative spectrum of ancient sediments and oils. These include several shales and oils ranging in age from 3 million to 2.7 billion years. Four homologies, isoprenoids, iso-, anteiso-, and cyclohexyl alkanes, were isolated by gas–liquid chromatographic procedures and identified by mass spectrometric techniques. A fifth homology, cyclohexyl-normal-alkanes, was tentatively identified. Accompanying tabulations present compositions, off scale mass spectral intensities, and gas chromatograms. Consideration is given to the problem of whether or not the hydrocarbons and their precursors extracted from rock samples are contemporary with the sedimentary deposit or result from later migration from some outside source. Arguments are presented for the indigenous nature of the organic matter; however, conflicting evidence from the thermal history of the Soudan Shale extractables leaves the problem unresolved. S.P.

N66-30298*# Dikewood Corp., Albuquerque, N. Mex.

COMPUTER PROGRAMS FOR THE GEOMAGNETIC FIELD Final Report

Francis J. Wall 13 Aug. 1965 108 p refs

(Contract NAS5-3944)

(NASA-CR-67856; DC-FR-1047) CFSTI: HC $4.00/MF $0.75 CSCL 08N

Two computer programs are developed for the spherical-harmonic expansion, which usually represents the geomagnetic potential function. Jensen's Fit is a least squares program for improving the precision of the parameters in the spherical-harmonic expansion. Wall's Error is a statistical program for mapping the field from the spherical-harmonic expansion produced by Jensen's Fit, and then computing the random error in the mapping. It establishes the relationship between errors in the given data and errors in the coefficients determined by a least-squares procedure. The basic formulation, which is similar for both programs, is mathematically defined. Program listings, brief descriptions, cross references, and flow charts are presented. S.P.

N66-30312# Library of Congress, Washington, D. C. Aerospace Technology Div.

SKY ILLUMINATION PHENOMENA Surveys of Foreign Scientific and Technical Literature

Joseph Javis and Daniel W. Michaels 16 May 1966 116 p Annotated bibliography

(ATD-66-55)

An annotated bibliography is presented for the Soviet-bloc and western open literature published between 1963 and 1966, with some earlier studies included. Abstracts are arranged by author according to the following categories: (1) airglow, (2) auroras, (3) noctiluscent clouds, (5) zodiacal light, (5) gegenschein, and (6) twilight. The material covered at the regular All-Union Conference on the Physics of the Upper Atmosphere, which took place in Moscow in April 1965, is reviewed. Reports dealing with various aspects of noctiluscent cloud research deal with formation, location, appearance, morphology, and climatology. The importance of the twilight method for sounding the upper atmosphere is indicated, and the use of various twilight methods in astronautics are reviewed.
M.W.R.

N66-30325# Adelaide Univ. (Australia). Dept. of Physics.
ROCKET DETERMINATION OF THE NIGHT OZONE DISTRIBUTION AND THE LUNAR ULTRA-VIOLET FLUX
J. H. Carver, B. H. Horton, and F. G. Burger (Weapons Res. Estab.) [1965] 18 p refs Sponsored in part by Australian Dept. of Supply
CFSTI: HC $1.00/MF $0.50

Ozone number densities in the altitude range 30 to 75 km have been determined at night by rocket measurements of the absorption of lunar ultraviolet radiation in three bands within the range of 2400 to 2900 Å. When compared with previous daylight rocket measurements of the ozone profile, the present results indicate a substantial nocturnal increase in the ozone density above 55 km, but the observed increase is not as large as that suggested by simple photochemical theories which assume a pure oxygen atmosphere. The measurements also provide new information about the lunar ultraviolet albedo.
Author

N66-30326*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BUTLER, MISSOURI—AN UNUSUAL IRON METEORITE
Joseph I. Goldstein May 1966 15 p refs Submitted for Publication
(NASA-TM-X-55499; X-641-66-225) CFSTI: HC $1.00/MF $0.50 CSCL 08D

The Butler iron meteorite has been found to have, with respect to the iron meteorites, an unusually high Co content (1.4 wt%), unusually high Ge contents in the kamacite and the taenite phases, and an unusually low cooling rate (0.5° C/10^6 years). It is suggested that the Butler meteorite formed in an environment different from that of the rest of the iron meteorites.
Author

N66-30342*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REPORT ON UNITED STATES—NEW ZEALAND SOLAR ECLIPSE PROJECT
Edward E. Bissell Apr. 1966 119 p ref
(NASA-TM-X-55519; X-721-66-153) CFSTI: HC $4.00/MF $1.00 CSCL 04A

This report discusses the operational aspects of the eclipse project, examines the airborne and ground based electronic systems, and deals briefly with the installation and operation of the boosted Arcas rocket system. During the May 1965 total solar eclipse, in a joint United States–New Zealand operation, six boosted Arcas rockets were successfully fired within 120 minutes from a remote location in Northern New Zealand. Five rockets were fired from a single launcher, while the last rocket was held in a ready condition and fired from a second launcher. Each rocket payload comprised a 12-pound miniaturized instrumentation system designed to gather and telemeter lower ionosphere electron and ion density data. Prelaunch and countdown preparations are supplied and sample radiation patterns for a dipole antenna enclosed within a plastic nose cone are included in an appendix.
Author

N66-30345*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
BEHAVIOR OF TOPSIDE AND BOTTOMSIDE SPREAD F AT EQUATORIAL LATITUDES
B. V. Krishnamurthy Apr. 1966 25 p refs Submitted for Publication
(NASA-TM-X-55522; X-615-66-159) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Using the Alouette I topside ionograms for equatorial latitudes for the period from September 1964 to February 1965, the diurnal behavior of topside spread-F and its association with magnetic activity has been studied. It is found that there is a negative correlation between the occurrence of topside spread-F and K_p indices. From a comparison of spread-F below hmF_2 as observed from the Huancayo bottomside ionograms and the topside spread-F at the same latitude, it is found that, besides the general similarity in their diurnal behavior, the onset of spread-F is earlier in the bottomside compared to that in the topside, and that the phenomenon decays later in the topside than in the bottomside. These results are examined in the light of current theories of spread-F and a qualitative explanation is suggested for the persistence of topside spread-F in the morning hours.
Author

N66-30372*# National Center for Atmospheric Research, Boulder, Colo.
ATMOSPHERIC SCIENCES FOR THE SPACE AGE
Walter Orr Roberts *In* NASA. Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 40–53 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

Increasing knowledge about the circulation of the global atmosphere and obtaining information about changing weather patterns are considered among the opportunities of space-age research programs. The present state of science and technology offers the possibility of making accurate forecasts two weeks in advance through the use of global-scale observations and large-capacity computers. The importance of such observations is stressed, and some illustrations are included to show some recent findings. These deal with solar corona and the hydrogen gas cloud ejected by the sun, Arctic jet stream pattern moving into Florida, peak rainfall related to lunar phases, and long-term influences in the atmosphere. Probable circulation patterns in the northern hemisphere are illustrated for 11th century and 1550–1660 winters. Global upper air observations points today are shown, and specifications are given for a superpressure Ghost balloon system for making atmospheric observations.
M.W.R.

N66-30429# Chalmers Univ. of Technology, Goteborg (Sweden). Research Lab. of Electronics.
SCINTILLATION OF DISCRETE RADIO SOURCES
Torleiv Aa. Orhaug 1965 124 p refs *Its* Trans., No. 299
CFSTI: HC $4.00/MF $1.00

The relation between the degree of scintillation observed at two discrete radio frequencies and various geophysical characteristics was investigated. The radio source Cygnus A was chosen because its angle of elevation at lower culmination is only 8.5°, and measurements were carried out at 33 and

150 Mc/s. The theory of scintillation is discussed with respect to forward scattering, the irregular region of the ionosphere, amplitude scintillation intensity and elevation angle, and background noise. The method of observation are described, and the results are presented in graph form. The rate step, or decrease of scintillation rate, was found to show a scintillation effect originating in the ionospheric E-region and to demonstrate a very definite southern limit of disturbed conditions in the E-region. The rate step was found to be a night time effect which occurs two hours after lower culmination. The amplitude of the density function was found to be always greater before the rate step takes place. The seasonal and daily variations, and their correlations with geomagnetic and ionospheric activity are discussed. N.E.N.

N66-30487*# Northrop Space Labs., Hawthorne, Calif.
DEVELOPMENT OF TECHNOLOGICAL CONCEPTS LEADING TO THE BENEFICIAL USE OF LUNAR MAGMA PRODUCTS Fifth Technical Progress Report, Apr.–Jun. 1966
E. Azmon [1966] 13 p
(Contract NAS7-358)
(NASA-CR-76165) CFSTI: HC $1.00/MF $0.50 CSCL 08G

Reported are 107 new determinations of solid–liquid phase transformations of igneous rocks from temperatures of 300°C to 2000°C. New data from petrographic analyses of tholeiitic basalts indicated that more glass occurred near and at the margins of the flow with no significant mineralogical changes taking place in the traverse. Petrographic and X-ray examinations of granodiorite showed that the original phases of plagioclase feldspar and quartz mostly disappeared near 35 kilobar pressure. Studies of serpentine under pressure at temperatures from 300°C to 1500°C established the following phases: serpentine–antigorite, olivine–forsterite, pyroxene–enstatite, and glass. Synthetic samples of forsterite 100, 80, 60, 40, 20, and fayalite 100 have been prepared for further examination. G.G.

N66-30502# Kodaikanal Observatory (India).
[PROMINENCE, MAGNETIC, AND IONOSPHERIC OBSERVATIONS FOR THE SECOND HALF OF 1960]
6 Oct. 1964 327 p refs *Its* Bull. No. 164
CFSTI: HC $7.00/MF $1.75

Photographs of calcium prominences at the solar limb during the second half of 1960, together with spectroheliograms from Mount Wilson and Meudon observatories, were evaluated for their mean daily area and their mean daily number. The obtained total values of 4.81 and 8.79, respectively, showed an increase of 32.5% in area and 25.03% in numbers when compared with corresponding values of the preceding half-year. In all, complete observations for about 161 effective days established the peak of activity in the northern hemisphere at 20° to 30° latitude, and in the southern hemisphere at 5° to 10°. G.G.

N66-30503# India. Meteorological Dept., New Delhi.
MAGNETIC, METEOROLOGICAL AND ATMOSPHERIC ELECTRIC OBSERVATIONS MADE AT THE GOVERNMENT OBSERVATORIES BOMBAY AND ALIBAG IN THE YEAR 1954 (1875–1876 SAKA). PART I: MAGNETIC OBSERVATIONS MADE AT ALIBAG
1964 66 p
CFSTI: HC $3.00/MF $0.75

Geomagnetic observational data from Alibag, India, during 1954 are presented. Tables contain the hourly values of the geomagnetic elements, their diurnal variations, the results of Fourier analyses of diurnal and annual variations of the elements, and mean and extreme values of the geomagnetic elements during 1954 and the preceding 10 year period. The value of the geomagnetic element H has been steadily growing since 1916 with an average rate increase of 51γ per year during this 10-year period. G.G.

N66-30504# India. Meteorological Dept., New Delhi.
MAGNETIC, METEOROLOGICAL AND ATMOSPHERIC ELECTRIC OBSERVATIONS MADE AT THE GOVERNMENT OBSERVATORIES AT BOMBAY, ALIBAG, ANNAMALAINAGAR AND TRIVANDRUM IN THE YEAR 1959 (1880–1881 SAKA). PART I: MAGNETIC OBSERVATIONS MADE AT ALIBAG, ANNAMALAINAGAR, AND TRIVANDRUM
1964 222 p ref
CFSTI: HC $6.00/MF $1.25

Geomagnetic data tables for 1959 from three Indian observatories are presented. Evaluated were declination, horizontal force, vertical force, diurnal variations of magnetic elements, Fourier analyses of the diurnal and annual variations of the vertical and horizontal forces, and the magnetic characters and disturbances. The value of the geomagnetic element H increased from 1916 to 1958 with a yearly average of 34γ during the past 9-year period; however, it decreased by 20γ from 1958 to 1959. G.G.

N66-30505# India. Meteorological Dept., New Delhi.
MAGNETIC, METEOROLOGICAL AND ATMOSPHERIC ELECTRIC OBSERVATIONS MADE AT THE GOVERNMENT OBSERVATORIES BOMBAY AND ALIBAG IN THE YEAR 1952 (1873–1874 SAKA). PART I: MAGNETIC OBSERVATIONS MADE AT ALIBAG
1964 72 p
CFSTI: HC $3.00/MF $0.75

The results of geomagnetic observations made at Alibag, India, during 1952 are shown in table form. Evaluated were hourly values of the geomagnetic elements D,H, and Z; the diurnal variations of D,H,Z,I,F, and Y; results of Fourier analyses on diurnal and annual variations of the elements; magnetic conditions and character values of geomagnetic elements during 1952 and the preceding 10 year period; and details of recorded magnetic disturbances. The value of H showed a steady increase since 1916 with an average gain of 54 γ per year. G.G.

N66-30519# Hawaii Inst. of Geophysics, Honolulu.
T-PHASE RADIATORS IN THE WESTERN ALEUTIANS
Rockne H. Johnson and Roger A. Norris Mar. 1966 24 p refs
(Contract Nonr-3748(01); ARPA Order 218-62)
(HIG-66-4; AD-632156) CFSTI: HC $2.60/MF $0.50

The aftershocks of the Rat Islands earthquake of 4 February 1965 provided a large volume of data for processing with a T-phase source location program. Although the earthquake epicenters were somewhat uniformly distributed through the Rat and Near Islands region, the computed T-phase sources were grouped in six clusters along the Aleutian arc. The clusters are considered to represent radiation from distinct sites along the Aleutian ridge. These sites are evidently submarine promontories which, due to their exposure, radiate energy over broader arcs of the pacific than do intervening regions. The relationship of T-phase strength to earthquake magnitude varied little among these radiators; however, T-phases from sources south of the Aleutian trench were significantly weaker.

identification of the arrivals from separate radiators in the signal from the main shock allowed an estimation of the length and velocity of the faulting. The estimate was 500 km and 3.5 km/sec. Author (TAB)

N66-30521# Newcastle Univ. (Australia). Dept. of Physics.
PROPAGATION OF PC1 MICROPULSATIONS IN AN IONOSPHERIC DUCT
Richard N. Manchester Feb. 1966 48 p refs *Its* Res. Publ. No. 14
(Grant Nonr(G)-00027-65)
(AD-632565) CFSTI: HC $2.00/MF $0.50

The propagation mechanism of Pc1 micropulsations from their relatively high generation latitude to middle and low latitudes is considered. The study is confined to the type of micropulsations commonly known as pearls or hm emissions. It is shown that propagation probably takes place in a duct centered on the F region of the ionosphere. The diurnal variations of the duct properties are calculated, using typical profiles for the ionospheric parameters at the time of sunspot minimum. It is shown that the duct has a low frequency cutoff at about 0.5 cps, implying that the lack of low frequency events at middle latitudes may be largely a propagation effect. Duct attenuation is very small during the night hours when the majority of Pc1 events are observed at middle latitudes, but is very large during the day. The calculated average horizontal component of the phase velocity for propagation in the duct is of the same order as that given in initial reports of experimental observations. Author (TAB)

N66-30557# Naval Radiological Defense Lab., San Francisco, Calif.
EFFICIENT DETECTION OF LOW LEVELS OF RADIOACTIVITY IN SEAWATER
Arthur H. Redmond 22 Mar. 1966 26 p
(USNRDL-TR-1000; AD-632284) CFSTI: HC $1.00/MF $0.50

The problem of assaying radioactivity in the sea has been under study with a view to designing an optimum detector for gamma radiation spectra, with suitable statistical accuracy. The responses of a series of crystal detector spheres of radii from 0.1 cm to 15 cm, having unit intrinsic efficiency to gamma rays has been calculated for unit gamma emitter per unit volume. The principal result brought out is the large increase in counting rate as the solid angle of acceptance of the spheres for gamma radiation increases. With larger spheres the sample volume increases but gives a negligible increase in counting rate. Graphs are given for the series of spheres for energies between 0.137 MeV and 3.6 MeV. A formula is given for the maximum counting rate for any size sphere under bombardment with any gamma ray energy. It can be used to estimate the size detector needed to count an emitter with required statistical accuracy, making allowance for intrinsic efficiency of the detector to gamma rays of a particular energy, and for any concentration of emitter. A procedure is outlined for selecting the particular isotope which has been activated by unit neutron fluence to obtain the maximum counting information in the shortest time. Differential counting of two isotopes over two different periods of time should give information on recency of activation. Author (TAB)

N66-30587*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.
NEGATIVE ION DETECTION IN THE IONOSPHERE FROM EFFECTS ON ELF WAVES Research Report, Jul. 1965–Mar. 1966
Stanley D. Shawhan Mar. 1966 57 p refs *Its* Rept.-66-11
(Grant NsG(T)-6; Contracts Nonr-93803; Nonr-1509(06))
(NASA-CR-76216) CFSTI: HC $3.00/MF $0.50 CSCL 04A

The theory for propagation of small amplitude electromagnetic waves in a cold, homogeneous plasma including negative ions and immersed in a uniform, static magnetic field is developed. It is found that for longitudinal propagation each negative ion introduces a resonance at the negative in gyrofrequency, a concentration dependent cutoff frequency above the negative ion gyrofrequency, and possibly a crossover frequency depending on the ion concentrations and charge to mass ratios. At both the gyrofrequency and the cutoff frequency the group refractive index becomes infinite. Between these two frequencies there is a nose frequency for which the group refractive index is a minimum. Examples are given for a three and five component plasma. This theory is applied to the inhomogeneous anisotropic ionospheric plasma and the resultant negative ion whistlers. Consideration is given to the validity of the WKB approximation, the existence of negative ions, and the effects of collisions. Sample frequency-time spectrograms are sketched to illustrate negative ion whistler traces and the information about negative ions which can be obtained from them. Author

N66-30605*# Pennsylvania State Univ., University Park. Coll. of Engineering.
F REGION ANALYSIS FROM RADIO PHASE DISPERSION MEASUREMENTS BETWEEN SEPARATING ROCKET CAPSULES Scientific Report No. 267
J. C. Widmaier 20 Mar. 1966 124 p refs
(Grant NsG-134-61)
(NASA-CR-76206) CFSTI: HC $4.00/MF $1.00 CSCL 04A

A unique high resolution technique has been employed to obtain absolute electron densities of the upper F region of the ionosphere. Propagation of two harmonic radio signals between two slowly separating rocket capsules and a measure of the ionospheric phase dispersion of these two signals with respect to a higher harmonic frequency reference was the essential principle employed. A successful payload was launched on May 19, 1965 from Wallops Island. The data reduction technique and results of the experiment are presented. An error analysis also accompanies the final electron density profile. Also presented with these results of the Mother–Daughter experiment are comparisons with simultaneous measurements of the electron density from an onboard planar ion probe, the topside sounding satellite Alouette, and a ground ion ionosonde at Wallops Island. Author

N66-30612*# Geophysics Corp. of America, Bedford, Mass. Technology Div.
PROCEEDINGS OF THE INTERDISCIPLINARY WORKSHOP ON VERTICAL RADIOMETRIC PROBING
E. T. Florance, comp. Jun. 1965 23 p refs Meeting held 23–24 Apr. 1965 *Its* Sci. Rept.-3
(Contract NAS5-3352)
(NASA-CR-76217; GCA-TR-65-12-N) CFSTI: HC $1.00/MF $0.50 CSCL 04A

Linear and nonlinear inversion methods, passive microwave radiometry, and Rayleigh and Mie scattering were considered by scientists, active in the field of electromagnetic sensing of the atmosphere by satellite, who attended an interdisciplinary workshop on vertical radiometric probing. Inversion techniques were discussed which have been found to be useful in inferring atmospheric thermal structure from remotely sensed observations of the microwave, ultraviolet, visible, and infrared spectra. M.W.R.

N66-30645# National Engineering Science Co., Pasadena, Calif.

WAVE SHOALING

R. C. Y. Koh and B. J. Le Mehaute 15 Jan. 1966 70 p refs

(Contract Nonr-4177(00))

(SN-134-9; AD-632849) CFSTI: HC $3.00/MF $0.75

This study is a contribution to a larger project for studying the 'modification of wave spectra on the continental shelf and in the surf zone'. Prior to dealing with a wave spectrum, a study of nonlinear effects of periodic waves appears to be necessary. For this purpose it is assumed that both friction effects and reflection effects are small. Then the principle of conservation of energy flux is applied to a periodic wave. This calculation has already been applied to a Stokes wave (periodic irrotational) to a third order of approximation (Le Mehaute and Webb, 1964). The purpose of this report is to perform the calculation up to the fifth order and to compare the corresponding result, with the third and first order of approximation. It will be the purpose of another (pending) report to present the limits of the principle of conservation of energy flux and to present a method of calculation which takes also into account bottom friction and reflection effect as well as nonlinear effects consistently. Author (TAB)

N66-30670# Army Electronic Proving Ground, Fort Huachuca, Ariz. Atmospheric Sciences Lab.

WIND TUNNEL MODELING OF VELOCITY PROFILES OF THE ATMOSPHERIC SURFACE LAYER

Harry W. Maynard Apr. 1966 23 p refs

(ECOM-6019; AD-633088) CFSTI: HC $1.00/MF $0.50

Many of the conditions commonly assumed for studies of the atmospheric boundary layer can be reproduced in a low-speed wind tunnel. Valid criteria are needed to determine similarity of flows obtained in wind tunnel experiments and natural flows. Reasonably good general indications are available from comparison of normalized velocity profiles from wind tunnel and field observations. In this paper, a dimensionless modeling parameter, K_*, is examined. This is a point parameter which is a function of both the local mean velocity and local turbulent shear stress. Preliminary results indicate that K_* has merit as a modeling parameter for the limited class of flows discussed. Author (TAB)

N66-30675# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

ELECTRIC FIELDS IN THE MAGNETOSPHERE Scientific Report No. 269

James W. Dungey 10 Apr. 1966 15 p refs

(Contract AF 19(628)-4014; Grant NSF GP-5611)

(AFCRL-66-300; AD-633251) CFSTI: HC $1.00/MF $0.50

The first approximation corresponds to perfect conductivity and relates to the DS circulation. The component E_{11} parallel to B must be controlled by charge neutrality and the interaction with low energy particles is most important. Electrons move fast compared to the characteristic time of the field and approximations can be used, but not for protons. Sudden changes in the situation occur at reconnection. In the tail the discussion concerns interdiffusion of plasma between the magnetosphere and the solar wind. The possibility of a large E_{11} being set up occurs only at the tail reconnection. The low electron density in the magnetosphere is still puzzling. Author (TAB)

N66-30682# Pennsylvania State Univ., University Park. Ionosphere Research Lab.

THE MEASUREMENT OF PHASE AND AMPLITUDE RADIO WAVE INTERACTION AT UNIVERSITY PARK, PENNSYLVANIA, OCTOBER–NOVEMBER 1965

Anthony J. Ferraro and Hai Sup Lee 15 Mar. 1966 36 p refs *Its* Sci. Rept.-266

(Contract AF 19(628)-4014; Grant NSF GP-846)

(AFCRL-66-263; AD-632665) CFSTI: HC $2.00/MF $0.50

The objective of the present work is to study the properties of ionospheric D-region using radio wave interaction effect which is also commonly known as Luxembourg effect. The present technique closely follows that developed by Fejer (1955) for radio wave amplitude interaction experiment. However, the technique of measurement as well as the theory of radio wave interaction have been extended and generalized at the Ionosphere Research Laboratory by the introduction of complex coefficient of interaction T, to embody the effect of interaction on both the amplitude and the phase of radio waves. Author (TAB)

N66-30692# Naval Research Lab., Washington, D. C.

THE EXTENT OF RADIOACTIVE EQUILIBRIUM BETWEEN RADON AND ITS SHORT-LIVED DAUGHTER PRODUCTS IN THE ATMOSPHERE Interim Report

L. B. Lockhart, Jr. and R. L. Patterson, Jr. 5 Apr. 1966 20 p refs

(NRL-6374; AD-633116) CFSTI: HC $1.00/MF $0.50

A set of experimental conditions has been derived which optimizes the accuracy with which the radon content of the atmosphere and its apparent residence time there can be determined from measurement of the filterable gross β activity during two separate 10-minute periods following the end of a 20-minute collection period. The 20-minute collection is made on a filter of essentially 100% retentivity (glass fiber filter) and counted for β activity through a 10-mil (70.mg/cm^2) aluminum absorber on equipment of known efficiency for the β particles emitted by RaB and RaC. The ratio of measured counts during the 61-through-71-minute decay period to that during the 1-through-11-minute period is employed to obtain the atom ratio of RaC to RaB (ρ) in the air sampled, the apparent age (τ) of the conglomerate of radon and its daughters, and the total counts to be expected from any given radon concentration in the air. Extensive examples of atmospheric measurements are given which suggest that under most conditions in the free atmosphere radon is essentially at secular equilibrium with its daughter products. Other collections made following addition of radon to a restricted volume show the expected increase in ρ with time, which confirms the basic validity of the procedure. Author (TAB)

N66-30868# Centre National de Recherches de l'Espace, Brussels (Belgium).

INTERPRETATION OF FLUORESCENCE OF N_2^+ IN THE AURORA [INTERPRETATION DE LA FLUORESCENCE DE N_2^+ DANS L'AURORE]

J. Hunaerts May 1964 43 p refs In FRENCH; ENGLISH summary Submitted for Publication *Its* Note Preliminaire No. 42

CFSTI: HC $2.00/MF $0.50

Analysis of the spectral properties of an aurora lit by the sun leads to the conclusion that the rotation and vibration temperatures must be identical. Examination of the conditions necessary for these temperatures to be equal in the fluorescence process shows that the presence of N_2^+ ions in thermal

equilibrium is required. The only process which allows thermal equilibrium is a charge transfer with symmetrical resonance between neutral and ionized nitrogen molecules, excluding other reactions. Hence, the rotation and vibration temperatures represent the real temperature of the thermosphere, which is abnormally high in the region where the aurora appears. Author

N66-30880# Centre National de Recherches de l'Espace, Brussels (Belgium).

INFLUENCE OF HELIUM AND HYDROGEN ON THE STRUCTURE OF THE UPPER ATMOSPHERE [INFLUENCE DE L'HELIUM ET DE L'HYDROGENE SUR LA STRUCTURE DE L'ATMOSPHERE SUPERIEURE]

G. Kockarts (Ph.D. Thesis) Jun. 1963 127 p refs In FRENCH; ENGLISH summary *Its* Note Preliminaire No. 29

CFSTI: HC $4.00/MF $1.00

The structure of the atmosphere being dependent on diffusion processes the author begins his study with the general equation of diffusion and then shows how it is possible to apply it to the diffusion of constituents like hydrogen and helium in an oxygen and nitrogen atmosphere. The different terms of this equation are discussed taking special account of diffusion coefficient and thermal diffusion factor. The solved equation of the diffusion flux continuity leads to determination of the beginning of the diffusion equilibrium of helium (110 ±5 km) and thus to the vertical distribution of this element. Helium and hydrogen influences are determined at different altitudes according to temperature. Data obtained from the variation of ECHO I Satellite were analyzed and compared to the theoretical results of this paper. G.S.

N66-30931# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).

MIGRATION OF RADIO ELEMENTS IN SOIL [MIGRATION DE RADIO-ELEMENTS DANS LE SOL] Final Report

L. Baetsle, W. F. Maes, J. Souffriau, and P. I. Staner Mar. 1966 66 p refs In FRENCH

(Contract EURATOM-002-63-10 WASB)

(EUR-2481.f)

Meteorologic and hydrologic observations at the Mol site were studied and led to a correlation between both phenomena. From these data the recharge rate of the aquifer and the real infiltration velocities were computed. A new device called Multicounter was developed for the in situ measurement of ground water velocity and direction in non-consolidated media. The apparatus is made of a stainless steel cylinder with four counter tubes piercing the bottom and one injection needle at the center of the bottom plate. The activities of the four counters are recorded simultaneously and provide Activity–Time plots which characterize the movement. Fundamental studies on the nature of the dispersion phenomena showed the existence of two distinct mechanisms being mainly influenced by the molecular diffusion. The dispersion coefficients vary between 10^{-3} and 10^{-5} cm^2/sec for velocities ranging from 10^{-2} to 10^{-4} cm/sec. Two techniques were developed in order to increase the soil's retention capacity for ^{90}Sr. The first one is based on the introduction of lignite treated with $K_4Fe(CN)_6+FeCl_3$, and the other consists of a treatment with HF followed by $K_2H_2Sb_2O_7$. Both "chemical barriers" catch all the ^{90}Sr found in 200 and 60 volumes, respectively flowing through the barrier. Author (NSA)

N66-30932# Atomic Energy Commission, New York. Health and Safety Lab.

FALLOUT PROGRAM Quarterly Summary Report, Dec. 1, 1965–Mar. 1, 1966

Edward P. Hardy, Jr. and Joseph Rivera 1 Apr. 1966 430 p refs

(HASL-171) CFSTI: HC $7.30/MF $2.00

Current data on fallout are presented that were obtained during 1965 from the HASL Fallout Program, the New Zealand Department of Scientific and Industrial Research, the New Zealand National Radiation Laboratory, Argonne National Laboratory, U. S. Naval Radiological Defense Laboratory and the USDA Soil Conservation Service. Data from previous studies are included for comparison. Radionuclide levels in fallout, milk, tap water, diet, and surface and high altitude air are given in tabular form. Also included are interpretive reports and notes dealing with fallout in the Pacific Ocean, depth distribution of ^{90}Sr in soil, development of a method for ^{90}Sr extraction from soil, ^{90}Sr contamination of reagents used in sea water analyses, and the transfer of ^{90}Sr fallout to cows' milk. NSA

N66-31088# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF THE GEOPHYSICAL BEHAVIOR OF Pb-210 BY APPLICATION OF ALPHA SPECTROMETRY [CONTRIBUTION A L'ETUDE DU COMPORTEMENT GEOPHYSIQUE DU PLOMB 210 PAR APPLICATION DE LA SPECTROMETRIE ALPHA]

Mehdi Nezami (Ph.D. Thesis—Paris Univ.) 1966 95 p refs (CEA-R-2886)

A study of the changes in the lead-210 contents of rainwater and of water produced by melting polar ice required the development of a method for dosing lead-210, an α emitter. The method is 40 times more sensitive than measuring the lead-210 by bismuth-210, a β emitter. The study of α spectrometry using semiconductor detectors is discussed along with advantages of the method. A new chemical separation method for polonium-210 and the results obtained are described. The results showed that the monthly lead-210 and polonium-210 contents in rainwater are approximately constant with time. In the Gif-sur-Yvette region, the clean-up by dry fallout can attain 40 to 50% of the total fallout. A study of Antarctic ice samples made it possible to determine an annual accumulation rate equivalent to 13.8 cms of water and to show discrepancies in the periodic concentrations that correspond to the latest maxima of solar activity. A balance was drawn up between the radon produced by the continents and the lead-210 fallout. Author (NSA)

N66-31104# Radiation Research Associates, Inc., Fort Worth, Tex.

MONTE CARLO CODES FOR STUDY OF LIGHT TRANSPORT IN THE ATMOSPHERE. VOLUME I: DESCRIPTION OF CODES Final Report, 1 Jul. 1964–31 Jul. 1965

David G. Collins and Michael B. Wells Ft. Monmouth, N. J., Army Electron. Command, Aug. 1965 102 p refs

(Contract DA-28-043-AMC-00240(E))

(RRA-T54-1; ECOM-00240-F, Vol. I; AD-625115) CFSTI: HC $4.00/MF $0.75

Monte Carlo procedures designated as LITE-I and LITE-II were developed to study the transport of light through the earth's atmosphere under various environmental conditions. LITE-I treats monochromatic light emitted from a point source, and LITE-II treats monochromatic plane sources of

light. The codes have been written in both ALGOL for the Burroughs B-5000 and FORTRAN II for other computers. The codes are sufficiently flexible to treat multiple scattering in an atmosphere in which air density and aerosol size distribution vary independently and arbitrarily with altitude. Provision for treating ground and cloud reflection with an albedo method is also available in the codes. The codes have been verified through comparisons with other calculations of light transport in the atmosphere. Utilization instructions, input data formats, sample problems, and the ALGOL listings of the codes are given to aid those who wish to utilize the codes. Author (TAB)

N66-31196# European Space Research Lab., Noordwijk (Netherlands).

CREATION OF AN ION CLOUD IN THE IONOSPHERE

R. Jeeschke Paris, ESRO, Mar. 1966 15 p refs

(ESRO-SN-50) CFSTI: HC $1.00/MF $0.50

An artificial ion cloud, released in the ionosphere by a sounding rocket, will afford a means of studying the behavior of the interplanetary medium under the influence of the solar wind, and help to arrive at a better understanding of the physical nature of cometary tails. The experimental conditions in which this cloud will be formed and then observed from the ground are described, as well as the procedure followed to derive its physical properties from the observed parameters. The main objectives of the experiment to be conducted in June 1966 are to test the release system and to determine what fraction of the material will actually have been vaporized. Author

N66-31200# Centre National de Recherches de l'Espace, Brussels (Belgium).

THE DENSITY OF A NEUTRAL GAS IN THE EXOSPHERE [DENSITE D'UN GAZ NEUTRE DANS L'EXOSPHERE]

M. Godart Oct. 1962 41 p refs In FRENCH; ENGLISH summary

(Rept.-25) CFSTI: HC $2.00/MF $0.50

The problem of the density of neutral gas in the exosphere is studied. The expression of the relative density of a neutral constituent at a given point in the exosphere can be derived directly from the Liouville theorem (valid only in the case of rare collisions, which is the hypothesis applied in this report). The author reviews different methods (Opik and Singer, Johnson and Fish etc.) according to the different types of particles. The temperature of the exosphere is also dealt with. I.M.

N66-31246# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.

MORPHOLOGY AND THE THEORY OF THE EARTH'S MAGNETIC FIELD AND ITS VARIATIONS [MORFOLOGIYA I TEORIYA MAGNITNOGO POLYA ZEMLI I YEGO VARIATSIY]

B. M. Yanovskiy Oct. 1965 213 p Transl. into ENGLISH from Zemnoy Magnetism (Leningrad), v. 1, 1964 p 23–193, 224–229, 260–269

(ACIC-TC-933; AD-623434) CFSTI: HC $6.00/MF $1.25

The geomagnetic field, its intensities, sources, and variations are reviewed. Methods of obtaining magnetic data on land and sea are described, and magnetic charts are included. The elements of the terrestrial magnetic field and an analytical representation of the field are presented. The fields of exterior, interior, and rotational sources, and the structure of the geomagnetic field are discussed. Secular variations are emphasized. Paleomagnetic studies and theories for the variations throughout history are described. N.E.N.

N66-31251# Teledyne, Inc., Alexandria, Va. Earth Sciences Div.

LONG RANGE SEISMIC MEASUREMENTS: RED HOT Scientific Report

Don M. Clark 6 May 1966 159 p ref

(Contract AF 33(657)-15919; ARPA Order 624; Proj. Vela Uniform)

(SDL-145; AD-632957) CFSTI: HC $3.00/MF $0.50

An analysis of seismological data from an underground nuclear explosion as a continuing study to provide information to aid in distinguishing between earthquakes and explosions. A table of travel-times and amplitudes of P, Pg, Lg, and surface waves are included along with other unidentified phases. Author (TAB)

N66-31259# Institute for Defense Analyses, Arlington, Va. Research and Engineering Support Div.

LEVELS OF NOCTURNAL ILLUMINATION

Lucien M. Biberman, Lawrence Dunkelman, Marion L. Fickett, and Reinald G. Finke Jan. 1966 196 p

(Contract ARPA SD-50)

(P-232; AD-632918)

Summary tables show, for four lunar months (mid-summer, mid-fall, mid-winter, and mid-spring), the number of hours in which the illumination exceeds levels in 8 decades from 1.5×10^{-6} foot to $1.5\times10^{+1}$ lumens per square foot; the full tables list the hours, day by day, in which the illumination exceeds the same 8 levels. Note that the sum of the hours not exceeding and the hours exceeding a given level equals a constant which is the total number of hours in a lunar month. So that these tables may be more easily understood, they also have been plotted at levels of 1.5×10^{-5}, 1.5×10^{-3}, 1.5×10^{-1}, and $1.5\times10^{+1}$. These curves show the number of hours per day as a function of date, the time that terrestrial illumination equals or exceeds these values. There are separate sets of tables for latitudes of 0 degree, 30 degrees, and 60 degrees. Author (TAB)

N66-31279# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

DYNAMIC BEARING CAPACITY OF SOILS. REPORT 2: DYNAMICALLY LOADED SMALL-SCALE FOOTING TESTS ON DRY, DENSE SAND

J. K. Poplin Sep. 1965 131 p refs

(TR-3-599; AD-623516) Available from Army Engr. Waterways Expt. Station, Vicksburgh, Miss.: HC $1.50; CFSTI: MF $1.00

The results of five static and nine dynamic tests on square, rectangular, and circular footings with a contact area of 64 sq in. on the surface of dry, dense sand are reported. Dynamic load pulses of various shapes with peak footing loads 1.5 to 3.0 times the maximum static load capacity of a particular specimen, and load durations from 30 to 825 μsec were used. Reaction, displacement, and acceleration of the footing were recorded. Accelerations within the specimen were sensed by accelerometers buried at various locations in the soil. Qualitative observations of displacement at various points in the specimen were made from the distortion of geometric patterns placed within and on the surface during preparation. The results of these tests indicated that the nature of displacements of a footing under dynamic loading appeared to be different from that observed for static loading. Shear surfaces, which normally develop upon failure under static loading, were not observed in the specimen after dynamic tests except for one test of relatively long duration. Displacement under peaked-pulse loading occurred

in a single phase and was dependent on the intensity and duration of the load pulse. Under sustained-pulse loading, two displacement phases were observed: (a) an initial phase which was dependent on the intensity of the load, and (b) a secondary phase which was dependent on the intensity and duration of sustained loading. Author (TAB)

N66-31282# Office of Naval Intelligence, Washington, D. C. Translations Section.
ON THE MAGNETOTELLURIC METHOD OF INVESTIGATION OF THE UPPER PORTION OF THE EARTH'S CRUST [O MAGNITO TELLURICHESKOM METODE ISSLEDOVANIYA VERKHNEI CHASTI ZEMNOI KORY]
N. P. Vladimirov [1965] 6 p Transl. into ENGLISH from a Russian paper presented at an All-Union Conf., Apr. 1961
(ONI-TRANS-1000-a; AD-633306) CFSTI: HC $1.00/MF $0.50

Theoretical, methodical, and technical problems are discussed in relation to the difficulties encountered in developing magnetotelluric prospecting methods based on the use of the natural electromagnetic field in the 0.5 to 1000 cps range. The potential of the method is also discussed, and curves of the impedance of the field Z and MTZ (magnetotelluric probing) are constructed from previously obtained data to serve as an example. Several investigations are reviewed, and the experimental curves obtained are analyzed. Results indicate that the proposed method makes it possible to study the electrical characteristics of deposits under precipitates of practically infinitely large impedance, which act as a screen for electroprospecting by constant current. M.G.J.

N66-31291# Stanford Research Inst., Menlo Park, Calif.
ONE-DIMENSIONAL STRESS WAVE PROPAGATION IN SOILS Final Report, Sep. 1964–Dec. 1965
Lynn Seaman Feb. 1966 175 p refs
(Contract DA-49-146-XZ-343; SRI Proj. PHU-5184)
(DASA-1757; AD-632106) CFSTI: HC $5.00/MF $1.00

Soil behavior during stress wave propagation was studied on a sand and two clays by making one-dimensional wave propagation tests on 5-meter long columns of the soils. Attempts were made to predict this behavior by determining soil properties in dynamic compression tests on small samples and by using these properties in a variety of mathematical models for soils. In all the wave propagation tests, stress and acceleration records were very similar, showing that the three soils differ in degree, not in kind. Peak stress and particle velocity attenuated to 20–40% of the peak value in the length of the 5-meter column. Two theoretical soil models were analyzed: one to investigate the effect of combined time-dependent and time-independent dissipation, and one to study the effects of nonlinear stress–strain relations and geostatic stress. Comparison of the theoretical predictions from the first of these and two previously studied models (using properties obtained from compressions tests on soil samples) with the wave propagation results shows: (1) for clays the arrival time of the wave at the column base was within 10% of that calculated from the tangent modulus, and for sand it was within 25%. (2) attenuation of peak stress and particle velocity was predicted within ±50% at the base of the column (5-meter length).
Author (TAB)

N66-31325# Iowa Engineering Experiment Station, Ames.
DEPTH STUDIES OF WISCONSIN LOESS IN SOUTHWESTERN IOWA. IV. SHEAR STRENGTH
N. S. Fox, R. A. Lohnes, and R. L. Handy [1966] 12 p refs
(Contract Nonr-4868(01))
(TR-2; AD-633121) CFSTI: HC $1.00/MF $0.50

This paper discusses the variation of the Coulomb shear strength parameters, cohesive shear strength, and angle of internal friction in the loess in a cut located in N. W. 1/4 sec. 3, T77N, R44W, Harrison County, Iowa. Author (TAB)

N66-31370*# Ohio State Univ. Research Foundation, Columbus. Dept. of Electrical Engineering.
MICROWAVE RADIOMETRIC TEMPERATURES OF TERRAIN
R. L. Riegler (M.S. Thesis) 30 Jun. 1966 74 p refs *Its* Rept.-1903-2
(Contract NSR-36-008-027)
(NASA-CR-76391) CFSTI: HC $3.00/MF $0.75 CSCL 08E

The concept of radiometric temperature is discussed; special attention is given to the problem of non-ideal antennas and a computer program is given for estimating surface radiation temperature from observed antenna temperature. Several surface and sky models are discussed and the equations for calculating their radiometric temperatures are given. Two working microwave radiometers were developed (10 GHz and 35 GHz) and used to measure the radiation temperatures for several types of terrain. Good agreement was obtained between the measured temperatures and temperatures computed from the theoretical models. Author

N66-31383*# Michigan Univ., Ann Arbor. Space Physics Research Lab.
AN ACOUSTIC WIND MEASURING TECHNIQUE Scientific Report No. 1
W. W. Bushman, G. M. Kakli, and G. R. Carignan Jul. 1965 56 p refs
(Contract NAS8-11054)
(NASA-CR-76411) CFSTI: HC $3.00/MF $0.50 CSCL 04A

A technique for measuring winds using the Saturn exhaust noise has been successfully employed to determine the wind profile over Cape Kennedy from ground to 85 kilometers. The purpose of this report is to describe the technique and to present the wind profile determined during the flight of the Saturn SA-9. The method of data reduction is described and a preliminary error analysis is presented. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N66-30025# Army Engineer Geodesy, Intelligence and Mapping Research and Development Agency, Fort Belvoir, Va.
PRECISION ENLARGING PRINTER (4X) Final Technical Report, May 1964–Jan. 1965
Andrew J. Bondurant, Jr. and Theodore L. Fick Mar. 1966 39 p refs
(Rept.-27-TR; AD-632122) CFSTI: HC $3.60/MF $0.50

This report covers the test and evaluation of the precision enlarging printer (PEP). The PEP is a 4-time-enlarging, projection-type printer designed to produce outputs with negligible distortion and extremely high resolution. The operation of the printer has been automated extensively to increase efficiency

of operation as well as accuracy of the printer. Tests were conducted to determine the design and operational characteristics of the printer with primary emphasis being placed on the distortion and resolution characteristics. The report concludes that: (a) The PEP will produce outputs with an area weighted average resolution (AWAR) of at least 150 lines/mm at the negative plane; (b) the distortion of the optical system does not exceed a circular probable error (CPE) of 2.65 microns at the scale of the negative; (c) the enlarging ratio of the PEP is 3.94; (d) the rate of production with the PEP is comparable with that of other widely used similar printers; and (e) the PEP is a relatively easy instrument to operate and requires very little maintenance. Author (TAB)

N66-30050# Joint Publications Research Service, Washington, D. C.

ELECTRICAL MEASURING INSTRUMENTS AND DEVICES: DIFFERENTIAL PHOTO-ELECTRO-OPTICAL REFRACTOMETER—GAS ANALYZER

B. P. Kozyrev and V. A. Korotchenko *In its* Izv. VUZov: Instr. Bldg. 27Jun. 1966 p 21–27 refs (See N66-30046 17-10) CFSTI: $5.00

A high-sensitivity differential refractometer for gases, made on the photo-electro-optical method for the amplification of low electrical signals, is described. The device can be used as a gas analyzer because it records variations in gas refraction indices on the order of 3×10^{-8}. Author

N66-30052# Joint Publications Research Service, Washington, D. C.

LOW INPUT CAPACITY DYNAMIC ELECTROMETER

T. M. Aliyev, L. A. Trachtenberg, V. V. Shcherbinin, and A. A. Ter-Khachaturov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 36–44 refs (See N66-30046 17-10) CFSTI: $5.00

A dynamic electrometer is described, which has input parameters $R_{in}=10^{15}$ ohm and $C_{in}=2$ pf, for the measurement of small charges at voltages up to 1000 V. It is based on the principle of type VZ-3 (MVL-3) millivoltmeter. The dynamic capacitor is made in the form of a fitting for the probe of the millivoltmeter. Results of theoretical and experimental investigations are given. Author

N66-30054# Joint Publications Research Service, Washington, D. C.

MEASUREMENT OF VERY SMALL DISPLACEMENTS BY MEANS OF INDUCTIVE TRANSDUCERS

Yu. G. Khvalov and O. I. Bloch *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 54–61 refs (See N66-30046 17-10) CFSTI: $5.00

Consideration is given to peculiarities in the measurement of very small displacements by means of inductive transducers connected in the measurement circuits with alternating and direct current loads. It is shown that the latter is more advantageous with respect to the greater signal steepness in the region of small deviations of the sensor from the null position. The required relations for calculations are given. Author

N66-30069# Joint Publications Research Service, Washington, D. C.

MODELLING NONLINEAR GYROSCOPIC SYSTEMS

V. G. Vorob'yev and R. I. Sol'nitsev *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 150–156 refs (See N66-30046 17-10) CFSTI: $5.00

Nonlinear gyroscopic methods are investigated by unifying the methods of modeling and harmonic linearization. Differential equations are given for a double-gyroscopic, uniaxial gyrostabilizer mounted on a moving platform. The structural diagram of the modeling equation is given, and the accuracy of the diagram is found. Differences between the modeling approximation and results calculated by linearization are found to be no greater than four percent. M.W.R.

N66-30070# Joint Publications Research Service, Washington, D. C.

ERROR COMPENSATION FOR THE INCLINATION OF THE GYROCOMPASS CASE

M. A. Sergeyev *In its* Izv. VUZov: Instr. Building 27 Jun. 1966 p 157–163 (See N66-30046 17-10) CFSTI: $5.00

This article considers the compensation of errors due to a tilting of a gyrocompass case with an elastic restoring moment by means of a shift in the center of gravity of the sensitive element along the major axis. Author

N66-30072# Joint Publications Research Service, Washington, D. C.

GYROSCOPIC METER OF THE INTEGRAL DIRECTION OF THE AERODYNAMIC MOMENT VECTOR

V. Yu. Torochkov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 171–174 ref (See N66-30046 17-10) CFSTI: $5.00

Circuit and theory are discussed for a gyroscopic device to measure the direction of the aerodynamic moment vector acting on some object. A description of the device is given, and its circuit is illustrated. A moving system of coordinates is used to construct the differential equations of motion, and a structural diagram for the device is constructed which can actually measure the integral direction of the aerodynamic moment vector. M.W.R.

N66-30073# Joint Publications Research Service, Washington, D. C.

SUCCESSIVE CORRECTION OF INDUSTRIAL ELECTRIC THERMOMETERS

Ye. M. Dushin and D. F. Khofman *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 175–180 refs (See N66-30046 17-10) CFSTI: $5.00

Dynamics of industrial electric thermometers are considered, as are means for determining the time constant of an equivalent first order inertial transducer for successive error correction. Parameters of industrial thermometers are graphed, and a correction example is given. Oscillograms of the transient responses of the uncorrected and corrected thermocouples are shown which indicate that a high-order correction circuit can be corrected with a first-order correction circuit. It is indicated that the effectiveness in correcting the circuit using a first-order correction decreases as the order of the transducer increases. M.W.R.

N66-30125# Joint Publications Research Service, Washington, D. C.

THE PROBLEM OF STEREOPANORAMIC PHOTOGRAPHY

M. M. Rusinov 27 Jun. 1966 13 p Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Geod. i Aerofotos. (Moscow), no. 2, Mar.–Apr. 1965 p 123–127 (JPRS-36194; TT-66-32627) CFSTI: $1.00

Panoramic photography, which is accomplished with a vertical position of the axis of rotation and shutter opening, is discussed. The difficulties noted in this method appeared to

be avoidable by stereoscopic surveying with a rotating base. With this technique, the magnitude of the stereoscopic parallaxes on the panorams does not depend on the azimuthal arrangement of the points, and it is possible to make the measurements at any section in space surrounding the point. Equations are formulated to show the feasibility of the technique, and the mechanisms and kinetics controlling the motion of the film opposite the shutter opening are calculated by conventional formulas of panoramic surveying. An image of a family of inclined cylindrical surfaces with a common axis of rotation of the apparatus was obtained, with the photographs having equal parallaxes. In accordance with this, the dependance between the distorted coordinates of the points on the photographs and their true coordinates was estabslished. Equations were formulated to accomplish the transition from the coordinates of the arbitrary point, determined for the inclined axis of the panoramic camera, to the coordinates with the vertical axis. L.E.W.

N66-30165*# ITT Industrial Labs., Fort Wayne, Ind.
HIGH RESOLUTION NIGHTTIME CLOUD-COVER RADIOMETER Quarterly Report XVII, 1 Oct. 1965–1 Jan. 1966
P. C. Murray, W. H. Wallschlaeger, R. Harber, P. R. Sargent, J. Whitacre et al 27 Apr. 1966 111 p
(Contract NAS5-668)
(NASA-CR-76092; ITTIL-66-1024) CFSTI: HC $4.00/MF $0.75 CSCL 20F

The electronic, optical, mechanical, and electronic packaging component and system designs of the radiometer are reviewed. The test equipment is described, along with some of the tests and test procedures. Schematic drawings and diagrams are included. D.T.

N66-30173*# Northrop Space Labs., Hawthorne, Calif.
DEVELOPMENT OF A METEOROID PENETRATION DISTRIBUTED TRANSDUCER Quarterly Report No. 4, Mar.–May 1966
H. R. F. Novotny Jun. 1966 70 p
(Contract NAS8-20194)
(NASA-CR-76102; NSL-65-138-4) CFSTI: HC $3.00/MF $0.75 CSCL 14B

Hypervelocity impact tests were conducted to evaluate experimental micrometeoroid impact sensors. Photographs illustrate oscilloscope traces of quartz crystal transducer outputs obtained on impacting aluminum target plates with 3.11 mg cylindrical lexan slugs at velocities of 18,000 to 30,000 fps. Stress wave arrival times to the various target points were compared. The lexan projectiles impacted the targets at three different angles: normally to the surface, and at 30° and 60° to the surface normal. Preliminary data analysis indicate: (1) The maximum peak to peak output amplitude is a function of the mass and velocity of the impacted particle, as well as of the distance traveled by the stress wave. (2) Impact location can be calculated from the difference in arrival times of the stress wave. (3) The interfering attenuation factor can be eliminated by comparing amplitudes and arrival times of outputs. (4) Impacting the target surface at oblique angles results in overall decreased output amplitudes. (5) The sensitivity of the sensor-preamplifier combination seemed high enough to detect impacts of projectiles with mass of 10^{-8} g. A brief review is also given of the laser simulation work performed. L.E.W.

N66-30285# Manchester Univ. (England). Dept. of Astronomy.
RESEARCH STUDY AND DEVELOPMENT OF 1-METRE MIRROR FOR MOON TRACKING AND PHOTOGRAPHY Final Scientific Report
Zdenek Kopal Jan. 1966 30 p
(Contract AF 61(052)-400)
(AFCRL-66-257; AD-632131) CFSTI: HC $2.60/MF $0.50

This document describes the lunar research programs carried out with the pic-du-midi 1-meter telescope up to the present time: tests carried out on the optics, tests carried out to determine the stability of the mounting and the tracking accuracy of the system, and planetary and other research carried out. Author (TAB)

N66-30280# Army Foreign Science and Technology Center, Washington, D. C.
CHECKING UP OF UNIVERSAL DEVICES SPR-2, SD-1, SD-1M
In its Photoelec. Determination of Geodetic Azimuth by Direct Method, Checking Up of Universal Devices SPR-2, SD-1, SD-1M Jan. 1965 p 8–20 (See N66-30278 17-13)

The errors incurred in using stereoprojectors and stereographs for processing aerial photographs, and means of reducing the errors are discussed. The predominate ways in which instrument components may become loose or impaired are identified, and ways of reducing or correcting them are presented. It is recommended that every 6 months the instrumental accuracy be determined from aerophoto mock-ups by a method which is described. N.E.N.

N66-30303*# Wyle Labs., Inc., Huntsville, Ala. Testing Div.
THE HOT WIRE ANEMOMETER
R. C. Potter Dec. 1964 75 p refs
(Contract NAS8-11312)
(NASA-CR-76135; WR-64-8) CFSTI: HC $3.00/MF $0.75 CSCL 14B

A description of the hot wire anemometer and its application to measurements in turbulent flows is given. The method of operation and the basic cooling equations are presented. Actual techniques for construction of the necessary equipment are reported and new techniques for determining the mean flow direction in three dimensional flow are included. An appendix is concerned with the operation of yawed wires and includes experimental results. These are used, in comparison with theoretical values, to determine the accuracy that may be expected when measurements of transverse velocity components are made. Author

N66-30338*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A DUAL TELESCOPE FOR SPECTROHELIOGRAPHY IN THE EXTREME ULTRA-VIOLET
J. Milligan, J. Underwood, and W. A. White 28 Mar. 1966 22 p refs
(NASA-TM-X-55515; X-614-66-132) CFSTI: HC $1.00/MF $0.50 CSCL 03A

The proposed dual telescope with fixed filters to trace the development in time and space of typical solar centers of activity is described. It will observe selected coronal radiations from Fe XVII in the 15–17 Å region and lower excitation phenomena in the 44–60 Å region. Imaging will be done simultaneously in the two band passes. Both images will have a resolution of 5 seconds of arc on axis and will be obtained photographically from two X-ray/EUV telescopes. Details are presented on the imaging elements, film, camera, filters, ancillary sensors, and the observing schedule. N.E.N.

N66-30352*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOLID-STATE WIDE-RANGE LOW POWER CAMERA TIMER FOR SPACE APPLICATIONS

Joseph C. Thornwall May 1966 28 p
(NASA-TM-X-55529; X-614-66-192) CFSTI: HC $2.00/MF $0.50 CSCL 14E

Specifications are given on a timing device developed to control the shutter of a camera designed to take preset time exposures of the sun during an Aerobee rocket flight. The film exposure times required varied from a fraction of a second to several hundred seconds, with a tolerance of ±10% from the nominal values. The camera and low-level electronic circuits were mounted in a package atop the rocket in an attitude controlled pointed section; the camera shutter timer and experiment battery supply were placed in a pressurized compartment below the pointed section. The electronic circuits in the pointed section were designed to recognize each positive-going transition in the waveform, i.e., t_3-t_5, etc. A simplified block diagram of the complete timer is given, including a waveform diagram showing the voltage signal produced on the output transistor. Details are also given on the field effect transistor (FET) timing one shot circuit, and on the typical voltage waveform at the trailing edge of a timing interval. Schematic depict the core flip flop circuit, and the core sequencer. M.G.J.

N66-30358*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DETERMINATION OF ACCURATE TIME ON OSO-I
William E. Behring May 1966 16 p
(NASA-TM-X-55535; X-614-66-212) CFSTI: HC $1.00/MF $0.50 CSCL 22B

A method of establishing an onboard clock is outlined, to determine the time at which various events in the data records from OSO-I occur. Although there are four different instruments on OSO-I that can be employed as timing devices, it is stated that no single device can be employed as an accurate timing device. It is reported that the proposed method uses a combination of these devices. The method involves the determination of the number of 51 second cycles of the channel 6 commutator from the last synchronizing pulse on one orbit to the last synch pulse on the next orbit, and determining the number of missing pulses during the five minute playback gap. The necessary additional steps in the process are discussed, and two computer programs to simplify the analysis of the channel 6 data are described. H.S.W.

N66-30359*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ROCKET SPECTROHELIOGRAPH FOR THE Mg II AT 2802.7 Å
Kerstin Fredga May 1966 49 p refs
(NASA-TM-X-55536; X-614-66-213) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A rocket-borne spectroheliograph designed to take monochromatic pictures of the sun in the Mg II line at 2802.7 Å is described in detail. The photographic system consists of a Questar telescope, a Solc-type birefringent filter and an automatic Robot camera. The double Solc birefringent filter had a spectral bandwidth of 4.0 and 3.5 Å respectively in the first and the two last flights. The two units in the double filter have been thoroughly tested and are compared with theoretically calculated transmission curves which they fit reasonably well. Two new types of linear film polarizers for the ultraviolet region have been tested and used in the filter. The temperature dependence of the filter has been determined, and a temperature control unit was developed which stabilized the filter temperature in flight to within ±0.2°C. The instrument has been tested in vacuum and to the Aerobee 150 vibration specifications. Author

N66-30421# Union Carbide Nuclear Co., Oak Ridge, Tenn. Oak Ridge Gaseous Diffusion Plant.
SOME OBSERVATIONS ON FILM BADGE CALIBRATION TECHNIQUES
A. F. Becher, N. B. Schultz, and L. H. Sipe 22 Apr. 1966 13 p
(Contract W-7405-ENG-26)
(R-1657) CFSTI: HC $1.00/MF $0.50

A mobile gamma radiation calibration unit utilizing a multi-Curie cobalt-60 source for the interpretation of radiation dose as determined from dosimeter film measurements is described. The radiocobalt source is encapsulated in an airfoil capsule which is raised and lowered by an enclosed, recycle air stream, permitting rapid and precise positioning of the source. A wide range of dose rates can be obtained by varying either or both the distance from the source and the exposure time. Doses ranging from 50 mrad to 2,000 rad can be obtained with only two exposure cycles. The results of tests to validate the accuracy of the film calibrations by use of a calibrated standard are presented. Author (NSA)

N66-30422# Union Carbide Nuclear Co., Oak Ridge, Tenn. Gaseous Diffusion Plant.
A DETECTOR FOR ALPHA RADIOACTIVITY IN FLOWING WATER
G. B. Seaborn 19 Apr. 1966 16 p refs
(Contract W-7415-ENG-26)
(K-1656) CFSTI: HC $1.00/MF $0.50

A detector was developed for monitoring continuously the alpha radioactivity in flowing water. The instrument is capable of detecting alpha levels down to 1 percent of the maximum permissible concentration allowed for human consumption. The required maintenance is minimal, and it is suitable for location in a remote area. The design and test results are described. Author (NSA)

N66-30433# European Atomic Energy Community, Brussels (Belgium).
DESCRIPTION OF A DEVICE FOR THE ACCURATE READING OF ACTIVITY PROFILES [DESCRIZIONE DI UNA APPARECCHIATURA PER LA LETTURA PRECISA DEI PROFILI DI ATTIVITA' SUI RADIOCROMATOGRAMMI]
V. Wagner and S. Forcheri May 1966 28 p refs In ITALIAN; ENGLISH summary
(EUR-2955.i) CFSTI: HC $2.00/MF $0.50

A description is given of a simple device for reading radiochromatographs accurately. The characteristics have been evaluated by examining some known activity profiles. An investigation has been conducted into the possibility of applying this device to the determination of activity profiles relating to the diffusion of tracers on chromatographic sites by the zone-diffusion method for ascertaining tracer-diffusion (self-diffusion) coefficients. Author

N66-30438*# Hughes Research Labs., Malibu, Calif.
RESEARCH ON GRAVITATIONAL MASS SENSORS Quarterly Progress Report No. 1, 15 Oct. 1964–14 Jan. 1965
R. L. Forward, Curtis C. Bell, and J. Roger Morris [1965] 95 p refs
(Contract NASw-1035)
(NASA-CR-67369) CFSTI: HC $3.00/MF $0.75 CSCL 17G

The development was begun of a small, lightweight sensor for use on probes and orbiters to measure the mass and mass distribution of extraterrestrial bodies. The major problem area is noise; this noise includes background clutter from

external forces and masses other than the one under investigation, external electrical noise and mechanical vibrations, and internal thermal and electronic noise in the sensor and amplifiers. The following conclusions were reached in both theoretical and experimental work. It was shown analytically that radially vibrating structures are not suitable for use as gravitational mass sensors because of a mechanical instability at a rotation frequency equal to 1/2 the vibration frequency. It was experimentally determined that transversely vibrating structures are stable under rotations at 1/2 their vibrations, and therefore, have the basic structural integrity necessary. Finally, in a separate development, it was demonstrated that it is possible to devise and instrument to measure independently the effects of acceleration, rotation, and gravitation—if the Principle of Equivalence is correctly interpreted. D.T.

N66-30466# European Atomic Energy Community, Brussels (Belgium).

DESCRIPTION OF A DOUBLE-DETECTOR LARGE-SURFACE SCINTILLATION PROBE [DESCRIZIONE DI UNA SONDA A SCINTILLAZIONE DI GRANDE SUPERFICIE A DOPPIO RIVELATORE]

G. Dominici and D. D'Adamo 21 Jun. 1965 16 p refs In ITALIAN

(EUR-2577.i)

A portable scintaillation alpha-beta detector of high sensitivity and counting efficiency for surface contaminations is described. The active detector surface made out of plastic scintillator and ZnS(Ag) has an area of 100 cm^2. Author (NSA)

N66-30479# Atomics International, Canoga Park, Calif.

EVALUATION OF THE COMBUSTION-THERMAL CONDUCTIVITY TECHNIQUE FOR THE DETERMINATION OF CARBON IN URANIUM CARBIDE (LECO 70 SECOND CARBON ANALYZER)

C. M. Larsen and D. N. Glass 30 Jun. 1965 28 p refs

(Contract AT(11-1)-GEN-8)

(NAA-SR-MEMO-11495) CFSTI: HC $2.00/MF $0.50

The determination of carbon in UC was accomplished by using a new commercial instrument, the Leco 70 Second Carbon Analyzer. The precision of the LCA, based upon the NBS 4i standard, is 0.015 wt. % carbon. Carbon determinations by the LCA are accurate. The precision of carbon determinations in cast and zone-refined UC material, is not significantly different than the precision of the NBS 4i standard (0.015 wt. % carbon). The cost per analysis by the LCA is approximately 1/4 that of the standard gravimetric method. This cost can be further reduced, under certain circumstances, by taking single instead of duplicate carbon determinations per sample. Author (NSA)

N66-30498# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

A SHORT TIME RESPONSE STAGNATION TEMPERATURE PROBE

R. A. East and J. H. Perry Mar. 1966 31 p refs

(AASU-264) CFSTI: HC $2.00/MF $0.50

A shielded thermocouple, total temperature probe has been developed capable of measuring mainstream and boundary layer maximum temperatures and temperature—time histories in a hypersonic gun tunnel. Experiments have indicated that temperatures up to a maximum value of 1500°K may be measured with high accuracy. The probe may in principle be miniaturized so that the outside diameter at the inlet is less than 1/32". Response times better than 10 milliseconds have been achieved. A survey of existing methods of measuring temperatures in short running time facilities is given and a comparison has been made with the results of the thermocouple probe. Author

N66-30536*# Aerojet-General Corp., Azusa, Calif. Life Systems Div.

DEVELOPMENT AND FABRICATION OF AN INSTRUMENT TO MEASURE INTEGRATED SKIN TEMPERATURE Final Report

Jun. 1966 42 p

(Contract NAS9-4067)

(NASA-CR-65415) CFSTI: HC $2.00/MF $0.50 CSCL 14B

This summary of the efforts to develop an instrument to measure the integrated skin temperature of a human, includes a functional description of the instrument, a discussion of its performance parameters, a description of the system components, and an examination of the environmental and functional tests conducted. The instrument is designed to be used either alone or inside a pressure suit, and by calibrating the instrument in terms of voltage change per unit of temperature change, it is possible to interpret body surface temperatures directly in terms of readout voltage. It is reported that the instrument meets performance specifications under dry suit operating conditions; however, it is also reported that it will not perform within specifications when the sensors are immersed in a simulated sweat solution. This failure is attributed to shorting of the sensor wires by the saline solution that penetrates minute cracks in the sensor wire insulation. A discussion of the efforts made to eliminate this insulation problem is appended. H.S.W.

N66-30541*# Aerojet-General Corp., Sacramento, Calif. Liquid Rocket Operations.

1.5 MILLION POUND LOAD CELL CALIBRATION AND H-AREA THRUST MEASURING SYSTEM Technology Report

W. A. Hoy, J. R. Close, and K. A. Vernon 27 Jun. 1966 114 p refs

(Contract NAS3-2555)

(NASA-CR-54793; AGC 8800-66) CFSTI: HC $4.00/MF $0.75 CSCL 11B

Studies were undertaken to develop a system for the calibration of force measuring cells to 1.5 million pounds. The five methods considered were: calculation of forces from a known area of a hydraulic piston and a known applied pressure, a combination of lower range cells set in parallel, a calibrated transfer standard, hydraulic pressure bellows, and a multiplication arm loaded by dead weight. A discussion of each of these methods is included. It is reported that the latter system was selected and added to an existing calibrated dead weight machine. It is also stated that the selected system has an accuracy of better than ±0.10% and is capable of applying loads in either tension or compression. Additionally included is a delineation of the design objectives of the H area thrust measuring system, along with the resulting design configuration. Results of the analytical studies which support the final design configuration are discussed. The calibration procedure is described in detail and the use of the calibration data to reduce thrust data from thrust chamber assembly firings is explained. H.S.W.

N66-30552# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THIN-FILM HEAT TRANSFER GAGES

John William Frye, Jr. (M.S. Thesis) Mar. 1966 80 p refs
(GAM/ME/66A-3; AD-632394) CFSTI: HC $3.00/MF $0.75

An extensive literature survey on thin-film heat transfer gages was accomplished and pertinent references are listed. Methods and techniques for fabricating, calibrating, and using thin-film gages are discussed. Thin-film gages were fabricated using liquid platinum paint applied to a quartz backing material, and were calibrated using the electrical single pulse method. Rates of heat transfer were determined for a station on the wall of a shock tube for the laminar boundary layer flow condition immediately after shock wave passage for shock Mach numbers between 1.15 and 2.50. The variation of the wall surface temperature with time associated with shock wave passage was also determined. The results were correlated with theoretically predicted values and with the experimental results given by Hartunian and Weatherston. The thin-film gages constructed for this study had determined values of $1/2\ (\pi\rho kc)^{1/2}$ of 0.067 ±0.005 $B/ft^2Fsec^{1/2}$, and measured values for sensitivity of resistance to temperature ranging from 0.000905 to 0.001375 ohm/ohm F. Author (TAB)

N66-30555# Navy Underwater Sound Lab., New London, Conn.

COMPUTATION OF TRANSDUCER VELOCITIES FOR VERY LARGE TRANSMITTING ARRAYS

David T. Porter 23 Mar. 1966 20 p refs
(USL-741; AD-630551) CFSTI: HC $1.00/MF $0.50

A method is proposed to compute the transducer velocities for large transmitting arrays by dividing each array into overlapping patches. Justification of the method is given in the form of computer results for line arrays of 10 to 30 elements steered from broadside at 60°, 75°, and 90°. It is shown that for the trailing end of an array steered close to end-fire, the transducer velocities are nearly independent of the length of the array. Author (TAB)

N66-30564# Human Engineering Labs., Aberdeen Proving Ground, Md.

TARGET DETECTION USING BLACK-AND-WHITE TELEVISION. STUDY II: DEGRADED RESOLUTION AND TARGET-DETECTION PROBABILITY

Lynn C. Oatman Jul. 1965 21 p refs
(TM-10-65; AD-625230) CFSTI: HC $1.00/MF $0.50

The study used a black-and-white closed-circuit television (TV) system to investigate the effects of two levels of TV resolution (800 and 450 lines) on the probability that subjects would detect an M-48 tank. While a previous study used horizontal degradation only, this one degraded the TV image in both horizontal and vertical dimensions. The tank was shown in each of nine areas of the TV screen, under both levels of resolution. Thirty subjects observing the TV monitor were asked to indicate in which of the nine areas the tank appeared. With changes in the horizontal resolution only, in the previous study, changing resolution from 800 to 400 lines did not affect target-detection probabilities significantly. But with both horizontal and vertical changes, subjects performed significantly better at the 800 level of resolution than at the 450 level. The tank's location on the TV screen, although confounded with other variables, appeared to have an important effect on target-detection probability. Author (TAB)

N66-30573# Adelphi Univ., Garden City, N. Y. Research Center.

A STUDY OF SENSITIVITY OF INCREMENTAL DERIVATIVE POLAROGRAPHY Final Report

Jun. 1965 11 p refs
(Contract AT(30-1)-2923)
(TID-22199) CFSTI: HC $1.00/MF $0.50

Studies were made on sensitivity improvement in the incremental derivative polarograph, a method for charging current compensation, and a criterion for resolution in the case of mutually overlapping polarographic waves. NSA

N66-30769# California Univ., Livermore. Lawrence Radiation Lab.

DETECTION AND DIAGNOSIS OF MALFUNCTIONS IN STRAIN GAGE SYSTEMS

Robert L. Osborne 14 Dec. 1965 14 p refs
(Contract W-7405-ENG-48)
(UCRL-14602) CFSTI: HC $1.00/MF $0.50

A method is presented for detecting, in a strain gage system, all short or open circuit conditions in either the strain gage bridge or in the cables connecting the bridge to the power supply and voltage-sensing equipment. The method necessitates the sensing of supply current and the addition of resistors to the balancing circuit. In the case of a bridge with a single active leg, no modification of the normal system is necessary for detection of malfunctions.

Author (NSA)

N66-30773# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

A LARGE AREA GAS PROPORTIONAL DETECTOR FOR LOW ENERGY PHOTONS

W. H. Tyree 6 Jan. 1966 22 p refs
(Contract AT(29-1)-1106)
(RFP-637) CFSTI: HC $1.00/MF $0.50

A large-area gas proportional detector developed for use in a whole-body counter is described. The photons associated with the alpha decay of ^{239}Pu are detected. A comparison of the sensitivity of the gas proportional detector and of an NaI(Tl) thin-crystal detector is included. NSA

N66-30777# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

A CONDUCTANCE DEVICE FOR MONITORING THIN FILM GROWTH

G. E. Hart, J. L. Martinez, and R. L. Beno 11 Mar. 1966 12 p
(Contract AT(29-1)-1106)
(RFP-690) CFSTI: HC $1.00/MF $0.50

A device that can be used to measure the very low resistances (0.02 to 10,000 ohms) of evaporated metal films is described. This will be of use in coating processes when the thickness of the metal being deposited must be controlled while the substrate is in the vacuum chamber. Accuracies in the range of ±2 percent were obtained on aluminum in the 200 to 3000 Å thickness range. Author (NSA)

N66-30811# Joint Inst. for Nuclear Research, Dubna (USSR).

CORRECTIONS FOR GEOMETRIC DISTORTIONS IN SPARK CHAMBER PHOTOGRAPHS [POPRAVKI NA GEOMETRICHESKIE ISKAZHENIYA NA SNIMKAKH S ISKROVYKH KAMER]

I. Bystritskii, F. Lehar, M. Maly, O. Sgon, and E. Yanout 8 Nov. 1965 18 p refs In RUSSIAN
(JINR-P-2420)

Geometric distortions appearing when particle tracks are photographed in spark chambers are tested. Formula

are deduced for corrections taking into account the distortion of the picture owing to: non-parallel alignment of the spark chamber wall and plane of the film; and non-alignment of the axis of the spark chamber lenses and those of the camera objectives. The corrections for the optical system used in measurements of elastic p-n scattering are calculated as an [illegible] NSA

N66-30835# Deutsche Akademie der Wissenschaften zu Rossendorf (East Germany). Zentralinstitut für Kernphysik.

A SIMPLE REACTIVITY METER OF HIGH SENSITIVITY [EIN EINFACHER REAKTIVITAETSMESSER HOHER EMPFINDLICHKEIT]

Hans-Georg Ebersbach, Peter Liewers, and Josef Scholtz Oct. 1963 23 p refs In GERMAN; ENGLISH summary (ZFK-RN-22)

The reactivity meter described is based on the simulator principle. It computes the value of the reactivity due to the time variation of the neutron density. For ionization chamber currents in the range of 10^{-8}–10^{-3} A reactivities of 10^{-5}–10^{-1} are measurable. The accuracy in the range $\rho = 10^{-4}$–10^{-2} is about 1%. Comparisons with conventional measuring methods showed a correspondence within 3%. The reactivity meter may be used for many purposes, especially for quick critical adjustments of reactors, for accurate and quick calibration of control rods, for the determination of power- and temperature-coefficients, etc. Author (NSA)

N66-30843# Los Alamos Scientific Lab., N. Mex.

AREA RADIATION MONITOR SYSTEM WITH LOGARITHMIC INDICATION AND AUDIO-VISUAL WARNING

M. J. Engelke, R. L. Henkel, R. D. Hiebert, H. K. Jennings, and H. J. Lang [1962] 13 p refs Presented at Particle Accelerator Conf., Washington, D. C.
(Contract W-7405-ENG-46)
(LA-DC-6790; CONF-650306-83) CFSTI: HC $1.00/MF $0.50

An improved neutron and gamma detection system for use with the Los Alamos large Van de Graaff accelerator was developed. The indicating system was expanded to give rapid visual information at the control room and other locations as well as audio alarms in the experimental area. By transistorizing all the electronic circuits and using only low voltages, both reliability and safety is improved. A gamma system, utilizing ionization chambers and an electrometer tube, is an integral part of the radiation system. It energizes the same alarm system as the neutron detectors. NSA

N66-30861# National Bureau of Standards, Boulder, Colo.

EARTH'S FIELD STATIC CALIBRATOR FOR ACCELEROMETERS

Paul S. Lederer and John S. Hilten 1 Feb. 1966 24 p ref (NBS-TN-269) GPO: $0.20

This paper describes a simple, relatively inexpensive system for the precise static calibration of accelerometers in the earth's gravitational field with an estimated limit of error of ±0.0004 g. The system consists of a precision machinists dividing head on a surface plate and a precision level. Experimental results obtained during the calibration of three types of accelerometers are shown to indicate the capabilities and usefulness of the system. Author

N66-30868# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

AN INFRARED STIMULABLE PHOSPHOR DOSIMETER FOR ELECTROMAGNETIC AND PARTICLE RADIATION

M. Sidran Jun. 1966 25 p refs (RE-258)

The feasibility of using an infrared stimulable ZnS phosphor for gamma dosimetry in the range 10^{-4}r to 10^{4}r is demonstrated in this report. With the novel readout procedure described here, the decay of stored energy no longer degrades the dose information, but instead provides additional information on the time elapsed between dose and readout. The dose information is stored in the deep traps. Both time and dose information are stored in the shallow traps. Successive exposures to two infrared bands separate and retrieve the information by means of the two stimulated luminescence peaks. The response is nearly linear with dose in the designated range. The low dose limits is set by background radiation, and the high dose limit by the density of traps in the material. Alternative gamma dosimetry procedures are described: (1) heat can be used instead of the first infrared exposure; (2) a single infrared band can be used to retrieve both time and dose; and (3) two spectral bands other than infrared might be used for retrieval. These procedures are also applicable for dosimetry of thermal neutrons, protons, alpha and beta particles, and all electromagnetic radiation with wavelengths shorter than those useful for stimulation. Author

N66-30884# Imperial Coll. of Science and Technology, London (England). Dept. of Geophysics.

A COUNTING SYSTEM FOR USE WITH THE RUBIDIUM MAGNETOMETER

S. Cierrocca, S. H. Hall, W. F. Stuart, and M. J. Usher [1966] 15 p refs Sponsored by Sci. Res. Council and Brit. Natl. Comm. on Space Res.
CFSTI: HC $1.00/MF $0.50

Rubidium magnetometers have been used by the Geophysics Department of Imperial College for ground observations of geomagnetic micropulsations and are to be flown in Skylark rockets as part of an investigation of the ionospheric current systems responsible for some of the variations of the geomagnetic field. A frequency counter using a 5 Mc/s standard has been developed and permits the total field to be measured with a sensitivity of 1/100 gamma at a sampling rate of 1 per second in a field of 50,000 gamma. In the rocket application a sampling rate of 30 per second is possible with a resulting sensitivity of 1/3 gamma. This report describes the counting and recording systems used, and the modifications for ground and rocket work. Author

N66-30896# Sandia Corp., Albuquerque, N. Mex.

A FAST-PULSE RECORDING AND READOUT DEVICE USING TUNNEL DIODES

J. R. Guth Dec. 1965 14 p
(Contract AT(29-1)-789)
(SC-TM-65-577) CFSTI: HC $1.00/MF $0.50

An analog memory device that is capable of recording the peak amplitude of a single pulse with a duration of 2 nanoseconds or more is described. The construction and performance of a practical peak-reading voltmeter based on this memory unit is also discussed. Author (NSA)

N66-30899# Union Carbide Nuclear Co., Oak Ridge, Tenn.

POSITION MONITORING DEVICES

L. G. Whitten 20 Apr. 1966 32 p
(Contract W-7405-ENG-26)
(Y-1506) CFSTI: HC $2.00/MF $0.50

Devices which monitor position over ranges of a few inches to several feet are discussed. Mechanical, optical and electrical concepts are covered. Clearly defined advantages and disadvantages are pointed out; however, no attempt is made to evaluate any one system with respect to another. Author (NSA)

N66-30905# Union Carbide Nuclear Co., Oak Ridge, Tenn.
DIAGNOSTIC AIR MONITORING AND RELATED SAMPLING EQUIPMENT FOR RADIOACTIVE AND TOXIC PARTICULATES
Merwyn Sanders 5 Jan. 1966 15 p Presented at the Symp. of the Baltimore–Washington Chapter, Health Phys. Soc., Gaithersburg, Md. 18 Sep. 1965
(Contract W-7405-ENG-26)
(Y-KB-64; CONF-650963-1) CFSTI: HC $1.00/MF $0.50

Sampling techniques and equipment that are used in uranium processing areas and in sampling other air pollutants are described. In the general air monitoring program in the Y-12 Plant, an IBM aperture card is equipped with a filter medium to collect air samples. Advantages of the system and other potential applications are listed. NSA

N66-30966# European Atomic Energy Community, Brussels (Belgium).
CRYOSTAT IN THE GASEOUS PHASE [UN CRYOSTAT EN PHASE GAZEUSE]
R. Debeir and M. Grin 1966 12 p In FRENCH
(EUR-2710.f)

A cryostat working in the gaseous phase is described. The thermostatic fluid is nitrogen which is vaporized in the measuring chamber. The apparatus is characterized by a very manageable operation and can be used at every temperature between room temperature (20°C) and the temperature of liquid nitrogen (−196°) and can be adapted to various physical measurements (resistivity, tension tests at low temperature). Author (NSA)

N66-30968# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TRANSLATOR WITH CORE MEMORY FOR THE TREATMENT OF DATA IN NUCLEAR PHYSICS EXPERIMENTS [TRASLATORE CON MEMORIA TAMPONE PER IL TRATTAMENTO DEI DATI IN ESPERIENZE DI FISICA NUCLEARE]
E. De Agostino and A. Sano Jan. 1965 21 p In ITALIAN
(RT/EL(65)1)

A system for automatic transmission of data from several detection units to one recording device is described. The system, used for data recording from photographs analysis of nuclear events, contains a ferrite-core intermediate memory. Author (NSA)

N66-30980# California Univ., Berkeley, Lawrence Radiation Lab.
ORTHOGONAL DISPERSION SPECTROMETER FOR MISSING MASS SPECTRA
C. M. Ankenbrandt, A. R. Clark, Bruce Cork, T. Elioff, L. T. Kerth et al 6 May 1965 19 p refs Presented at the Purdue Instrumentation Conf., 12–14 May 1965
(Contract W-7405-ENG-48)
(UCRL-11995; CONF-650510-7) CFSTI: HC $1.00/MF $0.50

For interactions of the type $M_1+M_2 \rightarrow M_3+M_4$ the kinematics of both initial particles and one secondary particle determine the reaction completely. Given a fixed initial state and any missing mass M_4, the momentum-angle correlation for particle M_3 is determined uniquely. In the spectrometer described, this correlation is preserved as a line image in the focal plane of a double focusing magnetic lens. Dispersions both in the plane of production and at right angles to it separate the images corresponding to different values of M_4, for which the spectrum is obtained directly by means of a 28-counter hodoscope in the focal plane. Each hodoscope counter is gated with a scintillation and Cherenkov counter telescope to identify particle M_3. During each beam pulse the outputs from the hodoscope counters are recorded on 10 Mc scalers. Between accelerator pulses the contents of these scalers are read onto magnetic tape and into a PDP-5 computer, which accumulates, corrects, and displays the data continuously to provide an on-line monitor. Author (NSA)

N66-31001# Sandia Corp., Albuquerque, N. Mex.
A HIGHLY STABLE TEMPERATURE CONTROL UNIT FOR MEDIUM VOLUME TEMPERATURE CHAMBERS
Virgil L. Dugan Jun. 1965 21 p
(Contract AT(29-1)-789)
(SC-TM-65-268) CFSTI: HC $1.00/MF $0.50

A system was designed to control the temperature of medium volume enviromental chambers within 0.1°F of a desired temperature. This control system is particularly applicable to the Statham Model SD-6 chamber; however, the control scheme itself could be used for practically any application. Author (NSA)

N66-31015# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
AN ELECTROPHOTOGRAPHIC DEVICE FOR EVALUATING PARTICLE TRACK COORDINATES IN A SPARK CHAMBER [ELEKTROFOTOGRAFICHESKAYA USTANOVKA DLYA OPREDELENIYA KOORDINATTREKOV CHASTITS V ISKROVOI KAMERE]
V. A. Biryukov, I. I. Promova, and A. F. Pisarev 1966 10 p refs In RUSSIAN
(JINR-P-2594)

A possibility is investigated of developing a device for filmless extraction of information from the spark chambers. The device involves a metallic drum whose external surface is covered with a layer of electrophotographic material. The spark projection leaves a potential well on this layer which is read off by a static transducer. It is shown experimentally that selenium and selenium–tellurium electrophotographic materials can be successfully used to construct this device. Author (NSA)

N66-31016# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
BASIC CHARACTERISTICS OF A MAGNETIC SPECTROMETER WITH A FIELD VARIATION
N. I. Tarantin 1966 17 p refs In RUSSIAN
(JINR-P-2573)

The basic ion-optical characteristics (dispersion and angular aberrations of the second order) of a possible spectrometer with a field variation are investigated for different types of spectrometers. Author (NSA)

N66-31028# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
DEVELOPMENT AND PERFORMANCE STUDIES OF A SCINTILLATION SPECTROMETER [REALISATION ET ETUDES DES PERFORMANCES D'UN SPECTROMETRE A SCINTILLATION]
Jean Berthier, Pierre Locard, Jean-Claude Hocquenghem, and Gerard Goin Mar. 1966 80 p refs In FRENCH
(CEA-R-2901)

A scintillation spectrometer based on the "fast–slow" coincidence technique is described. The counters use 56 A.V.P. fast photomultipliers. The fast coincidences unit can also be used as time-to-height pulses convertor. The resolving time, with two NaI crystals, is about 14 nanoseconds. It is shown that the following measurements can be made: β-γ or γ-γ coincidences, "sum spectra," lifetime measurements, and β-γ or γ-γ directional angular correlation measurements (with detection or not of the linear polarization). The results of test measurements are given. NSA

N66-31042# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Institut fuer Kernphysik.
REPORT OF THE NEUTRON-DIFFRACTION GROUP, DARMSTADT-FRANKFURT/M [ARBEITSBERICHT DER NEUTRON-ENBEUGUNGSGRUPPE DARMSTADT-FRANKFURT/M]
Feb. 1966 39 p refs In GERMAN; ENGLISH summary
(IKF-16)

The neutron diffractometers at the research reactor FR-Frankfurt/M. and FR2-Karlsruhe are described. The following investigations are reported briefly: slow neutron detectors for diffractometers, a high sensitive neutron-camera, Debye-Waller factor of diamond and silicon, distribution of cations in Mn–Zn–ferrite. Author (NSA)

N66-31048# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
SPIN ECHO SPECTROMETER [SPEKTROMETR ECHA SPINOWEGO]
W. Antoniak and J. Chmielewski 1965 37 p In POLISH; ENGLISH summary
(INR-619/XV/E)

A nuclear magnetic resonance spectrometer based on spin echo technique is used here for studies on possibilities of moisture measurements in different solid substances. The spectrometer consists of the following principal units: electromagnet measuring head with crossed coils, preamplifier, rf amplifier, pulse voltmeter, pulse transmitter, pulse pair generator and auxiliary units such as power supply etc. Electromagnet with 30 mm gap between poles 150 mm diameter has approximate field strength of about 2300 Oe. Measuring head accepts standard glass probes with external diameter of 13 mm which corresponds to sensitive volume of about 3 ccm. Normal operating frequency is 10 MHz. Noise level of receiving system including measuring head corresponds to 0.3 μv. Echo pulse amplitude is measured on peak voltmeter with long time constant. Pulse pair generator delivers two pulses, first being 20 μsec width and the second 40 μsec. Delay time of the second pulse may be varied from 100 μsec to 300 msec. Spectrometer as a whole consists of two items: an electromagnet placed on a cart and a standard rack containing 3 mounting panels with individual plug-in units for particular circuits. Some results of measurements of moisture in several substances and corresponding relaxation times are included. Author (NSA)

N66-31052# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DEVELOPMENT OF A JUNCTION β SPECTROMETER. APPLICATION TO STUDY OF THE SPECTRA OF ^{14}C AND ^{35}S [SPECTROMETRIE β PAR DETECTEUR A JONCTION. APPLICATION A L'ETUDE DES SPECTRES DU ^{14}C ET DU ^{35}S]
Akira Hashizume (Ph.D. Thesis, Paris Univ.) 1966 78 p refs In FRENCH
(CEA-R-2839)

A β-spectrometry unit using junctions of the silicon surface barrier type was built. The resolving power of this spectrometer was studied as well as the influence of a certain number of parameters (temperature, polarization voltage) on its characteristics. This spectrometer was used for a study of β-spectra in ^{35}S and ^{14}C. The calculations and corrections required for the setting-up of Kuries representation are described. The programs required for the carrying-out of these calculations with an I.B.M. computer are given. Author (NSA)

N66-31058# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Plant.
REACTOR ON-LINE COMPUTER INPUT SIGNAL SYSTEM
R. V. Studley and J. D. Bickely Mar. 1966 34 p Presented at Instr. Soc. of Am., Southeastern Conf. and Exhibit, Augusta, Ga. 19–21 Apr. 1966 Submitted for Publication
(Contract AT(07-2)-1)
(DPSPU-66-30-3; CONF-660408-2) CFSTI: HC $1.00/MF $0.50

The reactor on-line computer monitors 3300 analog and 50 switch contact signals. Each signal is switched to a General Electric 4128 computer input and measured once very 5 minutes with an accuracy on the order 9.1% of full scale. Thermocouples, with signal levels below 10 millivolts d-c, provide 78% of the signals and differential transformers, with output voltages of about 200 millivolts rms a-c, 17%. The remaining signal sources include resistance thermometers, angular position sensors, flow meters, voltage and current sources, and the outputs of various instruments. The computer accepts two simultaneous analog inputs in ranges of 0 to $\pm$10 or 0 to $\pm$50 millivolts d-c. The large number and variety of input signal sources require 11 different signal conditioning systems, a-c and d-c standards for calibration, and the means to select input signals. The conditioning systems, the circuits, the switches, and an output control circuit are described. Author (NSA)

N66-31118# Brown (D.) Associates, Inc., Eau Gallie, Fla.
MATHEMATICAL TARGETING II: THE ANALYSIS OF ANALYTICAL AEROTRIANGULATION TECHNIQUES BY SIMULATION METHODS Final Report
Ronald G. Davis, Frederick C. Johnson, and Maurice S. Gyer Griffiss AFB, N. Y., RADC, Feb. 1966 135 p refs
(Contract AF 30(602)-3404)
(RADC-TR-65-418; AD-629628) CFSTI: HC $13.00/MF $1.00

The problem of applying analytical block aerotriangulation techniques to targeting is studied by means of simulation methods. Photographic clocks of various configurations are adjusted and the resulting errors tabulated, graphed, and analyzed. The results of the study indicate that simulation methods are a powerful tool for analyzing the effectiveness of various photographic block configurations for the determination of the positions and elevations of ground targets. An operational set of electronic computer programs for performing either simulation or actual rigorous analytical adjustment of medium-sized (up to 32 photographs) blocks of metric aerial photography, on the CDC 1604-B Computer complex at Rome Air Development Center are described in outline. Author (TAB)

N66-31168# Technische Hochschule Darmstadt (West Germany). Institut fuer Stroemungslehre und Hydraulische Maschinen.

SIMPLE METHODS AND INSTRUMENTATION FOR VERY SHORT EXPOSURE, HIGH REPETITION RATE KINEMATOGRAPHY IN CONJUNCTION WITH FLUID ATOMIZATION STUDIES Final Report

F. N. Scheubel, A. Fritzsche, and H. Wendt Aug. 1965 51 p refs

(Contract AF 61(052)-651)

(AFCRL-65-774; AD-623569) CFSTI: HC $3.00/MF $0.50

The high voltage discharge of a pulsed light source with coaxial capacitor and extremely low inductance (Fischer–Nanolite) was employed successfully for ultra-short-time exposure of rapidly changing phenomena in the boundary layer of two-phase-flow. Design and operation of the electronic trigger-unit controlling high voltage discharge and shot series limitation are described. The high speed cameras and the lighting device developed in this way were used to investigate the atomization of liquids. In order to study the disintegration itself it is necessary to get distinct exposures of particles in the order of some hundredth of a millimeter and velocities of more than one hundred meters/second. A simple calculation indicates that exposure times in the nanosecond range are required. TAB

N66-31175# Santa Barbara Research Center, Goleta, Calif.

PRODUCTION ENGINEERING MEASURE PbSe INFRARED DETECTOR—TYPE IR-200, VOLUME I Final Engineering Report, 1 Jan. 1963–31 Aug. 1965

G. H. Cook 10 Nov. 1965 356 p ref

(Contract DA-36-039-AMC-01466(K))

(AD-624207) CFSTI: HC $4.00/MF $1.00

The design requirements of SCS-34A as revised were translated into engineering drawings. Engineering samples of the IR-200 detector were fabricated and evaluated. Tooling and test equipment was designed and fabricated to support a production rate of fifteen detectors per 8-hour shift. Twelve preproduction detectors were fabricated and tested, with difficulties encountered. A second group of twelve preproduction detectors was fabricated with no difficulties encountered. Twenty-five units were fabricated and acceptance tested for the pilot run. Operation times and yields were established, and a production capability of fifteen units per 8-hour shift was confirmed. A Project Quality Manual was prepared and submitted for approval. Inspection and Test Procedures were prepared for each required step in the manufacturing and test sequence. Manufacturing Procedures were written for each manufacturing operation. The manufacturing and inspection requirements were integrated by an operation flow chart. Delivery of the special tooling and the Bill of Materials is being made simultaneously with the submission of this report. Author (TAB)

N66-31198# Imperial Coll. of Science and Technology, London (England). Dept. of Geology.

AN APPRAISAL OF MAGNETOMETERS FOR SOUNDING ROCKET INVESTIGATIONS OF THE IONOSPHERE

S. H. Hall, M. J. Usher, and W. F. Stuart Apr. 1965 35 p refs

CFSTI: HC $2.00/MF $0.50

To make this appraisal as realistic as possible, it is strictly limited to selecting the best magnetometer based on specific rockets and specific experimental objectives. A summary of pertinent characteristics of current jets, sporadic E and S q currents is followed by a description of Skylark, Centaur and 7-1/2" rocket features that directly influence the selection of a magnetometer. Magnetometers are appraised in this report only as regards types previously used in similar experiments and only from the point of view of characteristics affecting the choice. Since rapid progress has been achieved in the improvement and diversity of magnetometers in recent years, a separate review is included on future instrumental possibilities and where development might be fruitful, for more complex experiments. Author

N66-31231*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

THE DESIGN AND DEVELOPMENT OF A DYNAMIC BRUSH WEAR MEASUREMENT APPARATUS

J. C. Horton and J. E. Owens

8 Apr. 1966 34 p refs

(NASA-TM-X-53425) CFSTI: HC $2.00/MF $0.50 CSCL 09C

An apparatus that permits the continual measurement of electrical brush wear in high vacuum is described. As the sensing element a linear voltage differential transformer is used, and its output is displayed on a potentiometric recorder. Resolution may be obtained from 0.0001 inch to 0.025 inch total wear, thus permitting wear-rate measurements from 10^{-7} inches/hour to one inch per hour to be made. Calibration curves are shown, and the results from several tests are plotted and analyzed. Accuracy is shown to be better than ±0.5 percent. Author

N66-31292# Ballistic Research Labs., Aberdeen Proving Ground, Md.

AN ATTITUDE DETERMINING SYSTEM FOR SPINNING ROCKETS

Joseph M. Conley and R. B. Patton, Jr. Dec. 1965 50 p refs

(BRL-R-1291; AD-632679) CFSTI: HC $2.00/MF $0.50

An attitude sensor for spinning rockets and the associated digital computing procedure have been developed and tested. The measuring system consists of a commercially available flux gate magnetometer and a single solar cell with a fan-shaped acceptance beam. The computing procedure is designed to improve approximations of the rocket aspect angles by successive differential corrections which are derived by a least squares treatment of an overdetermined system of condition equations. Both the measuring system and the computing methods have been found to provide a practical approach for determining rocket aspect. The system is estimated to have been accurate to between one and two degrees in its initial test and to have a potential accuracy of better than one degree. Author (TAB)

N66-31294# Virginia Polytechnic Inst., Blacksburg.

THE DEVELOPMENT, FABRICATION, AND EVALUATION OF A DEVICE FOR THE MEASUREMENT OF THERMAL PROPERTIES OF SOIL Final Report, Jun. 1964–Jan. 1966

S. T. Hsu and H. S. Kao Jan. 1966 250 p refs

(Contract NBy-32275)

(AD-632080) CFSTI: HC $6.00/MF $1.50

Statement of the problem: (a) to design, develop, fabricate and evaluate a probe device embodying the line heat source concept for the in situ measurement of the thermal conductivities of soils; (b) to develop and evaluate the technique, using the probe device, for measuring the thermal conductivities of soils in situ; (c) to design, develop, fabricate and evaluate a heated disk device based upon the contact principle for the in situ determination of the thermal diffusivities of soils; and (d) to develop and evaluate the technique, using the heated disk, for measuring the thermal diffusivities of soils in situ. Author (TAB)

N66-31300# Picatinny Arsenal, Dover, N. J.
APPARATUS FOR THERMAL ANALYSIS WITH PROGRAMMED SCHEDULE
A. L. Khutsaidze May 1966 11 p refs Transl. into ENGLISH from Soobshch. Akad Nauk Gruz. (USSR), v. 26, no. 6, 1961 p 681–686 *Its* Tech. Transl.-13
(AD-633218) CFSTI: HC $1.00/MF $0.50

A new variant of the EPP-09 electronic automatic recording potentiometer, designed for use in differential thermal analysis, is described in detail and discussed. Advantages of the new apparatus, which records its findings on tape, are listed. A number of typical thermograms made with the EPP-09 are given. Author (TAB)

N66-31310# Ballistic Research Labs., Aberdeen Proving Ground, Md.
COMPUTER PROGRAM FOR THE SINGLE MODEL ORIENTATION CASE OF THE GENERAL PROBLEM OF PHOTOGRAMMETRY
Lila M. Butler Oct. 1965 99 p refs
(BRL-MR-1704; AD-633047) CFSTI: HC $3.00/MF $0.75

This report presents an electronic computer program for the analytical solution of the 'single model orientation' problem, based on the theory documented in BRL report No. 1065 (PB-145 274). The most recent developments of the analytical solution for the general problem of photogrammetry, as developed by H. H. Schmid, are included in this program. The program will solve single model orientations under all conditions. Author (TAB)

N66-31321# Office of Naval Intelligence, Washington, D. C. Translation Section.
ACCURACY IN DETERMINING THE VERTICAL COMPONENT OF THE GEOMAGNETIC FIELD FOR AN ELECTROMAGNETIC CURRENT MEASURING INSTRUMENT [O TOCHNOSTI OPREDELENIYA VERTIKAL'NOY KOMPONENTY GEOMAGNITNOGO POLYA DLYA EMITA]
V. V. Novysh [1965] 19 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 5, no. 4, 1965 p 718–724
(ONI-TRANS-2094; TT-66-61283; AD-633271) CFSTI: HC $1.00/MF $0.50

Methods of obtaining the values of the vertical component of the magnetic field H_z at sea are discussed, and the fundamental error in existing magnetic charts is identified as the failure to consider the anomaly of the magnetic field and the error in the corrections because of variations. A schematic chart of relative errors in the H_z, as determined from the magnetic charts and by means of towed magnetometers, is included. The 24-hour solar variations are examined, and the maximum values of deviation estimates and the rating of H_z are listed. The magnitude of possible deviations of H_z are characterized for northern and southern geographic latitudes. The overall influence of magnetic activity on increased errors in calculating H_z is evaluated. Results show that the errors due to periodic variations do not exceed 1/2 of 1%; during large magnetic storms, the error can increase to 1% at the middle latitudes, and 2.5% at the high latitudes. Equatorial zones are considered, and it was found that the overall rated absolute error magnitude of the H_z determination equals ±530 gammas.
M.G.J.

N66-31365*# Boeing Co., Huntsville, Ala. Space Div.
PASSIVE INSTRUMENTATION AND STIMULI GENERATION FOR SATURN IB EQUIPMENT CHECKOUT. VOLUME I: SUMMARY TECHNICAL REPORT Final Technical Report, 26 Jun. 1965–31 May 1966
Henry N. Kaushagen and Kenneth L. Skinner [1966] 32 p
(Contract NAS8-20090)
(NASA-CR-76404; D5-13268-1) CFSTI: HC $2.00/MF $0.50 CSCL 14B

Techniques were investigated for passively injecting stimulus into and extracting information from space vehicle systems typified by the Saturn instrument unit systems. The selection of appropriate passive techniques is discussed, several selected techniques are described, and their application to the Saturn instrument unit is determined. The techniques described include magnetic and electric field techniques, infrared and heating techniques, optical and luminescent techniques, and mechanical and acoustic techniques. Requirements and definitions of stimulus generation and response evaluation equipment are also discussed. The study concludes that the passive instrumentation concept is feasible and can be applied to the systems of the Saturn instrument unit. When combined with evaluation and generation/programming equipment, the passive instrumentation concept can provide the capability to passively couple test stimuli into, passively extract response out of, and evaluate the status of the vehicle systems. R.N.A.

N66-31379*# International Business Machines Corp., Rockville, Md. Federal Systems Div.
LIQUID LEVEL SENSOR SYSTEM FOR CRYOGENIC PROPELLANTS Final Report
18 Mar. 1966 291 p refs
(Contract NAS8-11774)
(NASA-CR-76401) CFSTI: HC $6.00/MF $1.50 CSCL 14B

A prototype engineering model propellant level sensor system consisting of an electronics unit and a propellant probe was designed, constructed, and tested. The electronics unit uses a base band pulse reflection technique implemented by high-speed sampling methods to sense the propellant liquid level. The propellant probe is a light-weight twin lead transmission line driven from a very broad-band balun. Author

N66-31384*# Litton Systems, Inc., Minneapolis, Minn. Applied Science Div.
STUDY OF SUBMINIATURE TOTAL TEMPERATURE PROBES Final Report, 25 Jun. 1965–25 Mar. 1966
R. E. Larson and A. R. Hanson 7 Jun. 1966 44 p refs *Its* Rept.-2980
(Contract NAS8-20204)
(NASA-CR-76412) CFSTI: HC $2.00/MF $0.50 CSCL 20M

This is the final report of research on subminiature total temperature probes. It summarizes the development and fabrication of several types of small total temperature probes, and presents calibration results obtained for these probes in the wind tunnel probe-calibration facilities. The objective of the study was to develop subminiature total temperature probes which could be utilized in various boundary layer studies. The attainment of small size and the development of the special fabrication techniques required for these small probes were considered more important than satisfying an absolute accuracy requirement. Author

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N66-30028# Technological Lab. RVO-TNO, Rijswijk (Netherlands).

GENERAL PROTECTIVE SYSTEM AIR FILTERS OF FRENCH MANUFACTURE FOR TANKS [FILTERS VAN COLLECTIEF BESCHERMINGSSYSTEEM VOOR PANTSERVOERTUIGEN (FRANS FABRIKAAT)]

M. van Zelm 9 May 1966 21 p In DUTCH; GERMAN appendix (TL-1966-10; TDCK-45453) CFSTI: HC $1.00/MF $0.50

Wind tunnel tests were conducted to determine the effectiveness of a combined carbon and dampness filter. The carbon filter consists of two boxes made of 3 mm thick steel plate. The dimensions of the smaller box are about 59.5×22.5×10 cm; a layer of foam rubber separates it from the larger box which fits exactly over it. Four packs of pleated fiberglass are used in the dampness filter, which is attached to a metal pipe with plastic. Test data are tabulated and, although results indicate very high wind resistance, it was concluded that the overall effectiveness of the filters met the specifications. Transl. by J.O.

N66-30074# Joint Publications Research Service, Washington, D. C.

GENERAL PROBLEMS OF INSTRUMENT BUILDING: NOMOGRAMS FOR CALCULATING THE OPTIMUM QUANTITY OF SPARE ELEMENTS

O. G. Alekseyev and I. M. Fedorov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 181–186 refs (See N66-30046 17-10) CFSTI: $5.00

Graphical methods are considered for calculating the optimum quantity of spare elements using a so-called quickest release method. A nomogram method is shown which permits the determination of the optimum number of spares in terms of cost and number of reserve elements. This method, considered to have the advantage of simplicity over other methods, requires comparatively little computation. M.W.R.

N66-30075# Joint Publications Research Service, Washington, D. C.

CALCULATION OF ERRORS IN FANCY MACHINING

M. A. Luzhnikovskaya *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 187–194 refs (See N66-30046 17-10) CFSTI: $5.00

The subject of this article is the determination of the errors caused by the elastic deformations of the SPID-system in case the shaped profile is machined by transverse radial feeding. In calculating, the first thing to do is to find the equation for the thickness of the removed layer of metal; the error is determined as the difference between the specified tolerance and the area of the thickness-diagram of the removed layer, which expresses the actually removed overall layer of metal. Author

N66-30163# General Motors Corp., Indianapolis, Ind. Allison Div.

LABORATORY TESTS FOR EVALUATION OF SURFACE DETERIORATION IN GAS TURBINE ENGINE MATERIALS

George R. Sippel and John R. Kildsig *In its* Allison Res. and Eng., Vol. 10 [1966] p 20–35 refs (See N66-30151 17-34)

A series of simulated operating tests were developed for studying surface deterioration of gas turbine engine components. The tests were designed to produce damage similar to that found in actual service and were accepted only when the test results correlated to actual engine experience. It is noted, that these laboratory tests serve only to screen materials; actual engine tests of selected materials are still required to quantitatively evaluate their ultimate usefulness. Three types of wear were studied: (1) fretting wear, surface damage sustained by parts in close contact; (2) oxidation–erosion, the combined effects of metallic oxidation and high velocity gas erosion; and (3) sulfidation corrosion, an enhanced oxidation caused by salt in the ingested air and sulfur in the fuel. D.T.

N66-30414# Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.

DEVELOPMENT OF THORIUM-U^{233} IRRADIATION SPECIMENS

Sidney G. Nelson and Ellis L. Foster, Jr. 10 Feb. 1966 24 p (Contract W-7405-ENG-92)
(BMI-1761) CFSTI: HC $0.50/MF $0.50

Fabrication techniques were developed and employed in the preparation of irradiation and calibration samples to be used in a program designed to obtain equilibrium values of ^{233}U buildup in thorium in both fast and slow neutron-flux spectra. Twenty-two standard-calibration and 60 irradiation samples consisting principally of cores of thorium or thorium with additions of ^{233}U, gold, or boron surrounded by reactor-grade zirconium cladding metallurgically bonded to the core were prepared. All specimens were evaluated after their preparation. The results of fabrication, ultrasonic and autoclave (corrosion) testing of samples, and metallographic examination of core materials are discussed. Author (NSA)

N66-30416# Battelle-Northwest, Richland, Wash.

A BRIGHT-FIELD, GRAIN STRUCTURE ETCH FOR DELTA PHASE STABILIZED PLUTONIUM

D. D. Hays May 1966 8 p refs
(Contract AT(45-1)-1830)
(BNWL-188) CFSTI: HC $1.00/MF $0.50

An oxide-free surface delineating grain boundaries was produced in delta-phase, stabilized Pu alloys having a variety of metallurgical treatments. Zr-stabilized alloys were etched with solutions based on orthophosphoric, tetraphosphoric or citric acid. Delta-phase Pu stabilized with Al or Ga could only be etched with 200 ml ethanol, 116 g citric acid, and 10 ml of a solution of either potassium or sodium nitrate in 100 ml of water. Author (NSA)

N66-30489*# Hughes Research Labs., Malibu, Calif.

ALLOY IONIZER FABRICATION Summary Report

R. R. Turk and W. E. Mc Kee May 1966 176 p refs
(Contract NAS-3-6272)
(NASA-CR-54677; HRL-6272S) CFSTI: HC $5.00/MF $1.00
CSCL 13H

Fabrication of porous refractory ionizer material from prealloyed, spherical powders of narrow size range was investigated. Alloy powders used were 50 Ir–50W, 5 Re–95W, and 25 Re–75W (pure iridium was also included). Pellets from mixtures of elemental powders of the same elements were prepared in high density form. Fabrication techniques which were studied included warm pressing, joining methods, and surface treatment to keep pores open. Author

N66-30516# New York Univ., N. Y. Research Div.

THE SYNERGISTIC EFFECT IN ENVIRONMENTAL TESTING

Walter J. Kiernan Sep. 1965 39 p refs
(Contract NObsr-89288; Proj. Sete)
(SETE-228/7; AD-624233) CFSTI: HC $2.00/MF $0.50

The evidence in this report clearly indicates that test equipment, whether in transit, in storage, on board a moving vehicle, or in a fixed location is often subjected simultaneously, to many environmental stresses whose combined action on a

particular instrument is presently unpredictable. An examination of the available combined commercial test facilities demonstrates that few organizations can provide wide range combined environments. Most of the commercial companies limit themselves to standard groupings (i.e., temperature-humidity, temperature-altitude, etc.). Government facilities as a rule place greater emphasis on combined environmental testing. Yet even on extensive government installations the testing often is confinded to narrow objectives. The cost factor has frequently proven to be a major stumbling block in enlarging the scope of synergistic testing and must continue to be weighed against the advantages gained by introducing more complex test environments. The instant investigation has uncovered only three studies concerning the multienvironmental effects on electronic equipment. The results of these studies, however, were not positive and the authors pointed to the need for futher research into this important field. Author (TAB)

N66-30539*# Marquardt Corp., Van Nuys, Calif.
APOLLO SERVICE MODULE REACTION CONTROL SYSTEM ENGINE CHAMBER SEAL STUDY Materials Report
J. Puntar [1966] 83 p refs
(Contract NAS9-4775)
(NASA-CR-65420; MR-3008-F) CFSTI: HC $3.00/MF $0.75 CSCL 11A

Metallic and nonmetallic materials with low thermal conductivities and high strength are evaluated for possible use in high thermal resistance injector head–combustion chamber seals for the Apollo service module. Test procedures to determine structural properties, compressive strengths, and failure modes are summarized for small scale specimens of titanium alloy, Rene 41, a cobalt base alloy (20% cold worked), and for three grades of zirconium oxide. Data analyses show that sufficient safety margins were attained with these materials in combination with the desilicide coated molybdenum combustion chamber material. Thermal resistance measurements were also made on seal configurations including conical thinwall, straight thinwall, and composite (with zirconium oxide spacers); titanium and Rene 41 seals were used. Test results and data summary sheets are included. Further thermal evaluation was conducted on experimental zirconium oxide materials; results indicate that the materials are not suitable for use as spacers in the composite seal design. S.P.

N66-30580# Minnesota Mining and Mfg. Co., St. Paul, Minn.
FABRICATION OF TUNGSTEN ALLOY TUBING Progress Report, 1 Jul.–22 Oct. 1965
H. G. Sowman, A. Milmer, and D. D. Rowenhorst 10 Nov. 1965 12 p
(Contract AT(11-1)-1518)
(COO-1518-1) CFSTI: HC $1.00/MF $0.50

Small diameter tungsten–26% rhenium tubing was fabricated by the plastic extrusion of tungsten and rhenium powders combined with organic binders followed by sintering. Electron microprobe and metallographic analyses indicated a uniform alloy structure. Density exceeded 95% of theoretical. Bend tests were performed to determine ductility. Author (NSA)

N66-30583# Ghent Univ. (Belgium). Metallurgy and Metallography Lab.
THE WELDING OF HEAVY-GAGE STEELS Quarterly Report No. 14, 1 Jan.–15 Apr. 1965
[1965] 50 p Transl. into ENGLISH from a FRENCH Rept. Prepared jointly with Soudometal, S. A.
(Contract EURATOM-042-61-9RDB)
(EURAEC-1352; EUR-2327) CFSTI: HC $2.00/MF $0.50

Details and results of Robertson tests on symmetrical and asymmetrical welded joints and tensile tests on welded joints containing existing defects in steel plates 30 and 100 mm thick are reported. NSA

N66-30712# Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF PRACTICE FOR COMPOSITE ROLLING OF STRUCTURAL METAL PANELS First Quarterly Report, Nov. 15, 1965–Feb. 15, 1966
J. R. Van Orsdel, E. S. Bartlett, K. R. Grube, and H. R. Ogden Apr. 1966 33 p
(Contract DA-19-066-AMC-308(X))
(AMRA-CR-66-02/1; AD-632831) CFSTI: HC $2.00/MF $0.50

The program concerns the development of practice for panel fabrication from five specific materials. Inconel, PH 14-8Mo, and Maraging 18Ni-250 were studied during the first quarter. Preliminary sandwich panels of vertical-rib design were prepared from the three alloys with encouraging results. Refinement of surface-preparation techniques and preservation of clean surfaces until bonds are formed were found to be necessary to produce satisfactory bonding. Filler materials can be leached routinely with nitric acid without harm to Inconel and PH 14-8Mo structure, but care must be taken to avoid dissolution of the maraging structure. Acid concentrations of approximately 80 percent should be maintained when leaching carbon-steel filler from maraging-steel structures, and bath temperatures should not be allowed to rise above 140°F, the three alloys can be fabricated into structural panels by roll welding. However, compositional differences between alloys are undoubtedly responsible for bond-quality differences. The most readily formed bonds were in Inconel, followed by 18Ni-250 and PH 14-8Mo. Author (TAB)

N66-30765*# Aeroquip Corp., Jackson, Mich.
REPORT OF TEST ON THE EVALUATION OF MOUNTING METHODS AND DISTANCES FOR AEROQUIP SPACECRAFT BRAZED TUBING ASSEMBLIES
L. A. Deimen 31 Jan. 1966 72 p
(Contract NAS8-11336)
(NASA-CR-76260) CFSTI: HC $3.00/MF $0.75 CSCL 13H

To evaluate the brazed fitting concept for possible use on the Saturn vehicles, vibration tests were conducted to determine the proper mounting materials for hold-down clamps. Overall testing was performed to ascertain the preferred type of clamp to use as well as an optimum allowable distance between clamps. The test program also covered brazed fitting assemblies capable of 1500 psi operating pressure with 6000 psi minimum burst pressure for sizes from 1/4 inch through 1-1/4 inch, and assemblies of the 1-1/2-inch size with a 1500 psi operating pressure and 3750 psi minimum burst pressure. Maximum clamping distances for the vibrations conditions are tabulated, and test procedures are described. Test specimens are illustrated, and detailed data on the vibration tests are presented. S.P.

N66-30855*# Automation Industries, Inc., Danbury, Conn. Engineering Dept.
DEVELOPMENT OF A RING BEAM WHEEL SURFACE WAVE SEARCH UNIT Final Report

A. M. Murdoch 11 Apr. 1966 85 p
(Contract NAS8-11454)
(NASA-CR-76361) CFSTI: HC $3.00/MF $0.75 CSCL 13H

A ring beam wheel surface wave search unit was designed and developed to reduce the number of scanning angles needed for reliable detection of randomly oriented surface cracks. Details of the work program, work performed, and the results obtained on the unit's design and procurement, experimental assembly, wave study, and system layout are described. The feasibility of using the ring beam ultrasonic surface wave system for inspecting Saturn structural components was successfully demonstrated in a series of tests on small area specimens containing controlled simulated defects. R.N.A.

N66-30857*# Goodyear Aerospace Corp., Akron, Ohio.
DEVELOPMENT OF A LIGHTWEIGHT CRYOGENIC INSULATING SYSTEM Final Report, 30 Jun. 1964-31 May 1966
R. A. Burkely, A. H. Kariotis, F. D. Yoder, J. N. Apisa, P. Kost et al May 1966 240 p refs
(Contract NAS8-11761)
(NASA-CR-76368; GER-12269) CFSTI: HC $6.00/MF $1.25 CSCL 13H

This final report documents a 23-month effort to develop and perfect advanced lightweight panel insulation systems capable of providing efficient and highly reliable thermal protection when applied externally to cryogenic propellant tanks of launch vehicles. The primary effort was expended on the development of materials and fabrication techniques associated with 9 dual-seal cryogenic insulation concept. Thermal and structural characteristics of selected panel constructions were defined by liquid hydrogen tankage tests on a large oval-shaped tank. Author

N66-30858*# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.
MECHANISMS OF POROSITY FORMATION IN ALUMINUM WELDS
D. D. Pollock, W. V. Mixon, and W. W. Reinhardt Jun. 1966 130 p refs
(Contract NAS8-11332)
(NASA-CR-76369; SM-52039) CFSTI: HC $4.00/MF $1.00 CSCL 13H

The mechanisms of porosity formation and growth in static and bead-on-plate welds in 2219-T87 and 2014-T6 aluminum alloys were studied in terms of the water vapor in the helium shielding gas, arc current and voltage, arc-exposure time or travel speed, and thickness of parent plate. It was found that porosity formation in welds of these alloys results from the absorption of hydrogen by the molten alloys followed by the nucleation and growth of pores during solidification. The porosity nucleation rate is a function of the inverse square of the time required for the melt to reach the eutectic temperature. The porosity growth rate is a direct function of the square of the time required for the melt to reach the eutectic temperature. Porosity in the static welds is principally a function of the water vapor content in the arc atmosphere. The percent porosity, time to reach the eutectic temperature, hydrogen content, dendrite cell size, and number of pores in bead-on-plate welds are complex functions of water vapor in the shielding gas, arc current and voltage, travel speed, and thickness of the plate. Statistical analyses of the porosity responses of 2219-T87 and 2014-T6 alloys showed them to be identical within the limits of experimental error. Author

N66-30860*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
ALUMINUM O-RINGS FOR HIGH VACUUM USE
Benjamin Seidenberg, Alfred J. Hobbs, and J. J. Webb Jun. 1966 15 p
(NASA-TM-X-55542; X-713-66-280) CFSTI: HC $1.00/MF $0.50 CSCL 13E

Vacuum tests were performed on various annealed aluminum O-rings in an effort to find a type of metal ring that would be more economically attractive than the copper, indium, and gold rings widely used in vacuum systems today. The rings were constructed from aluminum welding rods, with the joints formed by various techniques of soldering, brazing, and welding. Three types, the butt-joint brazed, the wiped, dip-brazed, and the butt-welded, were found to hold a vacuum in the 10^{-8} torr range. A welded ring was also successfully tested on a G.E. system to 10^{-9} torr. The economic advantage of using these rings was proven when it was found that the cost of copper welded rings was approximately four times as great for comparable aluminum welded types. Author

N66-30886# Rocky Flats Div., Dow Chemical Co., Golden, Colo.
CERAMICS, RESEARCH AND DEVELOPMENT Quarterly Progress Report, Oct.-Dec. 1961
D. J. Kessell 21 May 1965 23 p refs
(Contract AT(29-1)-1106)
(RFP-518) CFSTI: HC $1.00/MF $0.50

Crucibles of AlN, TiC, TiN, ZrN, and Y_2O_3 were pressure-sintered in an induction heated graphite die. Reaction occurred between the die and TiN, ZrN, and Y_2O_3. The ZrN and Y_2O_3 crucibles were salvageable, but not the TiN. The design of a die assembly and the performance of several graphite susceptors for use in a new pressure-sintering unit are given. Progress in the isostatic-pressing of magnesia propellers and powder fabrication of small W crucibles is described. NSA

N66-30889# California Univ., Berkeley. Inst. of Engineering Research.
THE MECHANICAL BEHAVIOR OF FOAMED MATERIALS I: A LITERATURE SURVEY
M. R. Patel and I. Finnie May 1965 42 p refs
(Contract W-7405-ENG-48)
(UCRL-13193; MD-65-4) CFSTI: HC $2.00/MF $0.50

The mechanical properties and structure of foamed materials are reviewed. It was concluded that there is not yet a firm enough experimental background to support analytical attempts to predict foam properties from the knowledge of the properties of the base materials. NSA

N66-30915# European Atomic Energy Community, Brussels (Belgium). Joint Nuclear Research Center.
MECHANICAL RADIOGRAPHY TECHNIQUES FOR THE QUALITY CONTROL OF THIN WALLED SAP TUBES [PROCEDES DE RADIOGRAPHIE MECANIQUE APPLIQUES AU CONTROLE DE QUALITE DE TUBES A PAROIS MINCES EN SAP]
P. Bonnet and J. Jansen 1965 39 p in FRENCH
(EUR-2443.f)

For the control of light tubes intended for nuclear application, radiography may be quite useful if precautionary measures are taken as to the contrast. Furthermore double-wall techniques avoid the superimposition of images a

observed in conventional radiography. Two one-wall techniques were analyzed: the so-called rotative method and the rolling method. In the rotative method the film is rolled up on an expansible mandrel introduced into the tube by a special tool. The assemblage is then primed by a uniform rotative movement and exposed to X-rays collimated by a slit of adjustable width. Analysis of the method suggests that the focal distance may be short. By contrast, the slit must be small which leads to rather long, but not prohibitive, exposition periods. According to the rolling method a film carriage rolls at a velocity that approaches the peripherical velocity of the tube. The image of the wall becomes very fuzzy whereas that of the back wall rests sufficiently clear. The more intricate mathematical relations between the parameters necessitated digital computation. Greater widths of slit are acceptable in this case without impairing the quality of the image. Author (NSA)

N66-30978# AFC Industries, Inc., Albuquerque, N. Mex.
A STUDY TO DETERMINE THE FEASIBILITY OF AUTOMATICALLY CORRECTING MACHINE POSITIONING ERRORS Final Report, Phases I and II
Nov. 1965 62 p Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(ACF-204-1; SCL-DC-65-130) CFSTI: HC $3.00/MF $0.75

The feasibility of adjusting control tapes for numerically controlled machine tools or gages was investigated. The adjustments would be accomplished by computer postprocessing techniques and would compensate for predetermined machine positioning errors. Both advantages and disadvantages are discussed. NSA

N66-31054# Ghent Univ. (Belgium). Soudometal, S. A., Brussels (Belgium).
WELDING OF VERY THICK STEELS Final Report
[1965] 135 p Performed under United States–EURATOM Joint Research and Development Program [1965] 135 p Prepared Jointly with Soudometal, S. A.
(Contract EURATOM-042-61-9 RDB)
(EURAEC-1548; EUR-2690) CFSTI: HC $4.00/MF $1.00

Each process in the welding of very thick steel plates was thoroughly investigated in order to find a means to prevent the occurrence of brittle fracture. The steels used were similar to ASTM A302B, but with lower C and Mo contents, which was counterbalanced by Ni and Cr additions. The properties of the steel plates were completely characterized in the normalized-tempered and quenched-tempered states. Three welding processes were investigated: manual welding with coated electrodes, automatic welding with magnetic flux, and automatic submerged arc welding; filler metals were developed for each process. The conditions for embrittlement of the filler metal and welded joint due to the simultaneous work-hardening and aging during the welding process and the optimum restoration heat treatments were also investigated. NSA

N66-31108# Southwest Research Inst., San Antonio, Tex.
LUBRICATION RESEARCH FOR AERO PROPULSION SYSTEMS Phase Report No. 1, 1 Feb.–1 Sep. 1965
E. L. Anderson, B. B. Baber, and P. M. Ku Oct. 1965 42 p
(Contract AF 33(615)-2384)
(AFAPL-TR-65-118; AD-625485) CFSTI: HC $2.00/MF $0.50

Investigations were conducted to determine the possible affect of selected aircraft gas turbine engine lubricants and various solvents on the removal of carbonaceous deposits which had accumulated during service on the No. 2 bearing rear support of the J-57 engine. Six MIL-L-7808 type and one MIL-L-23699 type lubricants and six solvents were included in this program. Under the test procedures used, the deposits on the bearing support specimens were found to be quite stable in the presence of all seven lubricants investigated; no loosening or sloughing of the deposits was observed. Of the six solvents evaluated, only Cities Service 26 was found to be effective in removing significant amounts of deposits from the specimen. Flashing of liquid water, which had penetrated the deposit covered surface, loosened crinkled, blistered, and flaked deposits, but had no effect on smooth carbon or varnish. Author (TAB)

N66-31111# Ampex Corp., Redwood City, Calif.
INTERACTION BETWEEN SELF-ACTING AND EXTERNALLY PRESSURIZED EFFECTS IN A FOIL BEARING
Edward J. Barlow Oct. 1965 24 p refs
(Contract Nonr-3815(00)(X))
(RR-65-12; AD-625762) CFSTI: HC $1.00/MF $0.50

For a foil bearing, the interaction between the flow of lubricant from feed holes and the flow in from the surrounding environment is calculated numerically. The results are applicable for a partial arc foil bearing whenever the feed holes are far from both ends of the warp angle. The report extends the linearized solution into the nonlinear range. Author (TAB)

N66-31174# Westinghouse Electric Corp., Pittsburgh, Pa. Material Handling Projects Group.
CONSTANT RELATIONSHIP HOIST DRIVE SYSTEM Final Report, Jan. 1958–Mar. 1965
Richard L. Meyer Mar. 1965 57 p
(Contract NBy-53151)
(AD-623400)

The report covers the development and performance of the prototype Constant Relationship Hoist drive system built for test and evaluation for the U. S. Navy Bureau of Yards and Docks. This hoist system compensates for relative motion to give the operator control of the load. This is accomplished by feeding back into the regulator the relative motion of the unloading and loading stations and applying this signal into the drive system control to compensate the load for this relative motion. Author (TAB)

N66-31183# Florida State Univ., Tallahassee. Dept. of Statistics.
NON-PREEMPTIVE PRIORITIES IN MACHINE INTERFERENCE
Vincent Hodgson and Thomas L. Hebble Sep. 1965 18 p refs
(Contract Nonr-988(08))
(FSU-M-90; ONR-TR-17; AD-623830) CFSTI: HC $1.00/MF $0.50

A model of machine interference is studied in which one repairman is assigned to maintain several batteries of machines with a finite number of machines in each battery. The model, which assumes non-preemptive priorities, random breakdowns and general repair time distributions, is closely analogous to the classical priority queueing model of Kesten and Runnenburg. A system of equations for the multivariate binomial moments of the number of machines working in each battery immediately after a repair is completed, is established and solved. Author (TAB)

N66-31185# Army Engineer Waterways Experiment Station, Vicksburg, Miss.

A DIMENSIONAL ANALYSIS OF THE PERFORMANCE OF PNEUMATIC TIRES ON SOFT SOILS Final Report

Dean Richard Freitag (Ph.D. Thesis—Auburn Univ., 3 Jun. 1965) Aug. 1965 164 p refs

(TR-3-688; AD-621955) Available from Army Engr. Waterways Expt. Sta., Vicksburg, Miss.: HC $3.00; CFSTI: MF $1.00

Treadless pneumatic tires were tested in specially prepared soft soils with a single-wheel dynamometer that was instrumented to measure horizontal and vertical forces, torque, slip, and sinkage. The test tires were of different sizes so that the effects on performance of tire width and diameter could be determined, and the tires were tested at three different degrees of tire deflection. The load on the tire was varied, but the speed of the test wheels was held constant. Two different soils were studied—a wet, frictionless clay and a dry, cohesionless sand. The soil strength was varied over the full practicable range, but with a minimum of variation within a test section. The cone penetrometer was used to measure the resistance of the soil in each case. The experimental results showed, both for the clay and the sand, that the cone penetrometer measurement was a satisfactory means of describing the consistency of the soil, and that true scaled systems could be achieved. The data also showed the influence of each of the independent parameters. A single term was developed for each of the soils that combined all of the independent parameters and this term was shown to be related to the dependent parameters. TAB

N66-31203# Technische Hogeschool, Delft (Netherlands). Laboratorium voor Verbrandingsmotoren en Gasturbines.

DESIGN AND DEVELOPMENT OF ROTATING SLIP RING ASSEMBLY FOR COOLED GASTURBINE BLADE TEMPERATURE MEASUREMENTS

V. A. Ogale and A. J. M. S. Van Montfoort Dec. 1965 33 p refs

(Rept.-10.E.0/0) CFSTI: HC $2.00/MF $0.50

The design and development of a rotating slip ring assembly for in-operation temperature measurements of gas turbine blades are reported. The method uses a rotating slip ring-brush assembly to transmit signals from the revolving thermocouples to the stationary measuring instrument. The design and experimental results of a test rig to calibrate the thermocouple assembly are included. Temperatures up to 800°C may be measured. C.T.C.

N66-31220*# Pratt and Whitney Aircraft, East Hartford, Conn.

BRAYTON-CYCLE TURBOMACHINERY ROLLING-ELEMENT BEARING SYSTEM Third Quarterly Report, Jan. 2–Apr. 2, 1966

Herbert Means May 1966 59 p refs

(Contract NAS3-7635)

(NASA-CR-54991; PWA-2845) CFSTI: HC $3.00/MF $0.50 CSCL 13I

This report describes the work performed during this period on a design and experimental program formulated to investigate the potential of an oil lubricated rolling element bearing system for Brayton cycle space power machinery. Designs of the turbine compressor and turboalternator on rolling element bearings were completed. Designs of the experimental apparatus to be used in investigating the features of the lubrication systems were also finished and fabrication was initiated. Laboratory evaluation of candidate adsorbate materials included a 100-hour test of 13X molecular sieve pellets with satisfactory results. R.N.A.

N66-31240# Fighting Vehicles Research and Development Establishment, Chertsey (England).

THE LOCKING OF THREADED FASTENERS BY LIQUID SEALANTS

N. D. Brown 28 Sep. 1965 22 p

(M-58-W) CFSTI: HC $1.00/MF $0.50

It was required to establish the benefits to be derived from the use of locking sealants for the bonding of threaded joints for use on heavy vehicles. This report describes the procedure followed for assessing the torque values of bonding cements on bolts, nuts and assemblies of 3/8 in and 7/8 in dia. The degree of cleanness necessary to ensure repetitive results was also investigated. The cure time, effects of zinc plating components and the use of accelerators or activators to initiate setting of the sealant were recorded. Author

N66-31268# Air Force Machinability Data Center, Cincinnati, Ohio.

MACHINING DATA FOR TITANIUM ALLOYS

John Maranchik, Jr. 1 Aug. 1965 62 p

(Contract AF 33(615)-2161)

(AFMDC-65-1; AD-623588)

The objective of this pamphlet is to update the machining technology of titanium alloys. It provides starting machining recommendations for all current commercially-pure, alpha, alpha–beta, and beta titanium alloys for the following machining operations: turning, face milling, end milling-slotting, and milling-peripheral, drilling, reaming, tapping, broaching, and surface grinding. Tool drawings indicating tool nomenclature, as well as a grinding wheel chart, are included. The designation of alloys in the various machining charts is limited to one system, but an appendix provides a cross reference of alloy designations used by various producers and others. An appendix is also included which provides comments relating to the use of chlorine containing cutting fluid. Author (TAB)

N66-31269# Wisconsin Univ., Madison. Dept. of Statistics.

THE EFFECT OF EXPERIMENTAL ERROR ON THE DETERMINATION OF THE OPTIMUM METAL-CUTTING CONDITIONS

S. M. Wu and D. S. Ermer (Pennsylvania State Univ.) Jan. 1966 31 p refs Prepared in cooperation with Pennsylvania State Univ.

(Contract Nonr-1202(17))

(TR-61; AD-632518) CFSTI: HC $2.00/MF $0.50

The effect of experimental error on the determination of the minimum-cost cutting speed was investigated using the concept of statistical inference. The theoretical cutting speed for minimum cost (V_{min}) is not uniquely defined, but lies within a probable range of speeds because of the uncertainty in the parameter-estimates of the tool-life equation. The confidence interval for V_{min} depends on the magnitude of the cost-time parameter T_e; as T_e increases, the V_{min} confidence interval decreases. The confidence interval for V_{min} is affected by the experimental range of feed in tool-life testing; the smallest confidence interval is at the average experimental feed. A decision rule based on the minimax principle is used to illustrate the selection of a specific speed from within the V_{min} confidence interval. Author (TAB)

N66-31295# Naval Air Engineering Center, Philadelphia, Pa. Metallurgical Div.

EVALUATION OF THE STRUCTURE AND STRENGTH OF GLASS-DRAWN COPPER MICROWIRE

Paul J. Soltis 30 Mar. 1966 12 p refs
(NAEC-AML-2424; AD-633213) CFSTI: HC $1.00/MF $0.50

A size dependence was found in the strength of glass drawn copper microwires, and the finest wires, near 1 micron in diameter, showed the highest strength. Allowing for systematic errors in the measurement of the areas of cross sections of tension speciemns, there is sufficient evidence indicating that the finest wires are capable of strengths above 200 ksi. Although most of the copper microwires in the larger size range, 6–16 microns, showed strengths near 100 ksi, a few showed strengths near 40 ksi. This is contrasted with the near 30 ksi strength found in annealed, polycrystalline bulk copper; hence, strength then could be relation to degree of crystalline perfection. The X-ray diffraction data on a bundle of parallel larger size copper microwires indicates strongly the presence of preferred orientation, and therefore, a preferred growth direction. In view of the process used in producing the glass-drawn microwires and their unusually high strength capability, it is concluded that the wires can be grown in the form of almost continuous single crystals with few dislocations presented. Author (TAB)

N66-31298# Naval Ordnance Lab., White Oak, Md.
AN AUTORADIOGRAPHIC TECHNIQUE FOR STUDYING CRACK GROWTH IN PLASTICS COMPOSITE MATERIALS
Marlin A. Kinna 1 Apr. 1966 26 p refs
(NOLTR-66-2; AD-633236) CFSTI: HC $1.00/MF $0.50

Preliminary work has been conducted on segments of NOL rings to study crack propagation characteristics in fiber reinforced plastics composite materials. Samples were submitted to a variety of fatigue loading conditions. They were then immersed in a tritiated water-ethylene glycol solution and after suitable processing, autoradiograms were prepared for analysis. Radiation emanating from the solution retained by the samples indicated that minute cracks and fissures were present in all of the specimens and that the radiation intensity varied in direct proportion to the severity of the fatigue loading conditions. When photomicroscopy was used to analyze similar specimens, cracks could be detected only for the most severe test conditions. Author (TAB)

N66-31318# Linden Labs., Inc., State College, Pa.
MACHINING HIGH PURITY ALUMINA Quarterly Report, 28 Jun.–28 Sep. 1965
28 Oct. 1965 24 p *its* Rept.-5
(Contract DA-36-039-AMC-03634(E))
(QR-5; AD-632890) CFSTI: HC $1.00/MF $0.50

The rate of attack by 52% aqueous hydrofluoric acid on commercial grades of high purity alumina (96% and 94%) are discussed. The composition and the method of formation used appear to be parameters controlling the rate of attack. All 98% and 94% alumina engineering parts have been rendered friable by hydrofluoric acid treatment, machined and reconstituted. The 96% alumina parts have physical properties which suggest that they have been successfully reconstituted when fired to P.C.E. cone 33 (1745°C) for four hours and were simultaneously transformed into parts of at least 99% alumina or better. Although the 94% alumina has been capable of being rendered friable and machinable it has not been successfully reconstituted. Reconstitution at P.C.E. cone 33 resulted in dense bodies which were warped and distorted. The warping of plates, cylinders and rods was not improved upon by reconstituting under the less severe conditions of P.C.E. cone 31 (1680°C); in addition they had an open pore porosity of about 8% and, hence, would be unsatisfactory when measured against mil I-10 A. Author (TAB)

N66-31323# Franklin Inst., Philadelphia, Pa. Research Labs.
AN ANALYTICAL AND EXPERIMENTAL STUDY OF THE STRUCTUREBORNE AND AIRBORNE VIBRATION OF ROLLING ELEMENT AND SLIDING SURFACE BEARINGS Final Report
H. C. Rippel and J. H. Rumbarger 31 Mar. 1966 148 p refs
(Contract NObs-77184)
(F-A2321; AD-633146) CFSTI: HC $5.00/MF $1.00

An analytical and experimental study was made of bearing noise and vibration generation and transmission. Presented herein is: summary of previously reported work, report of most recent progress, conclusions drawn from all of the work accomplished, and recommendations for additional work. This final technical report coupled with the numerous periodic progress reports and special interim reports issued during the course of the program treats all aspects of the following three phases of effort: (a) analytical study of bearing noise and vibration generation and transmission, (b) design and construction of a test device to experimentally evaluate bearing structureborne and airborne vibration, and (c) experimental evaluation of bearing structureborne and airborne vibration. Author (TAB)

N66-31363*# Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn.
DEVELOPMENT OF ALKALI METAL PEROXIDE AND SUPEROXIDE BLOWN CERAMIC FOAMS Final Report, 22 Jun. 1965–15 Mar. 1966
E. W. Blocker and R. D. Paul 5 Apr. 1966 71 p refs
(Contract NAS8-20089)
(NASA-CR-76406) CFSTI: HC $3.00/MF $0.75 CSCL 11B

A program was conducted to develop a foam ceramic body for use as a thermal insulation. Specific areas studied included the formulation of foam ceramic bodies, using Li_2O_2 as the blowing agent, that achieve useful strength by a chemical bonding mechanism. The foam body was evaluated for physical/mechanical, thermal, and optical properties. A foam-in-place ceramic composed of zirconium phosphate bonded zirconia was prepared and evaluated. The foam bodies exhibited good thermal and mechanical properties when tested in accord with accepted testing procedures. Author

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N66-30013# Kansas State Univ., Manhattan.
SENSITIZED FLUORESCENCE Final Report, 1 Apr. 1963–31 Dec. 1965
Basil Curnutte, Jr. [1965] 57 p refs
(Contract Nonr-3634(02); ARPA Order 306-62; Proj. Defender)
(AD-632014) CFSTI: HC $3.00/MF $0.50

The quenching of mercury resonance fluorescence by thallium in a mercury–thallium vapor mixture has been measured to determine the quenching cross section of thallium for the 6^3P_1 state of mercury. The measurements for the quenching cross sections at 800°C, 850°C, and 900°C were 34 $\pm 13 Å^2$, 31 $\pm 8 Å^2$, and 25 $\pm 6 Å^2$ respectively. The cross sections for the transfer of energy to several of the thallium excited states on collision of ground state thallium atoms with excited and metastable mercury atoms were determined

by measurement of the relative intensities of thallium sensitized fluorescence radiation to mercury resonance fluorescence radiation. The implications of the magnitudes of these cross sections on the prospects for the use of a mercury–thallium vapor in a laser system are discussed. Author (TAB)

N66-30020# Lear Siegler, Inc., Santa Monica, Calif. Laser Systems Center.
SATURABLE FILTER INVESTIGATION Final Technical Report
L. A. Cross Apr. 1966 53 p
(Contract Nonr-4125(00); ARPA Order 306-62; Proj. Defender)
(AD-632007) CFSTI: HC $3.00/MF $0.50

This report presents the results of the search for suitable saturable filter materials and the theoretical investigation of the saturation effect. The observation of saturation effects in uranyl glass filters is discussed. The effect of a saturable filter in the laser cavity is demonstrated with an experimental Q-switched laser. Author (TAB)

N66-30158# Naval Ordnance Lab., Corona, Calif.
MAGNETO-OPTICAL OBSERVATIONS WITH A TEN-MILLIWATT HELIUM–NEON LASER
J. L. Tomlinson *In its* Foundational Res. Proj. 1 Mar. 1966 p 1–3 refs (See N66-30157 17-23) CFSTI: HC $4.60/MF $0.50

Magnetic domain patterns 1 cm^2 were observed by means of illumination from a 10-milliwatt helium–neon laser. These patterns covered a larger area and showed more contrast than previous domain observation with a lower powered laser. Observations at low speed were more successful than those at high speed. Author

N66-30264# Raytheon Co., Waltham, Mass. Research Div.
SPECTRAL AND MODE PROPERTIES OF SOLID-STATE LASERS AND OPTICAL DYNAMIC EFFECTS Final Report, Jan.–Dec. 1965
C. Tang and G. De Mars Jan. 1966 82 p refs
(Contract AF 19(628)-4981)
(S-852; AFCRL-66-202; AD-632566) CFSTI: HC $3.00/MF $0.75

Experimental results of a direct measurement of the frequency shift of the output of a single-mode traveling wave ruby laser are reported. A description is included of the preliminary experimental results obtained in a successful attempt at eliminating this frequency shift by introducing a compensating phase shift in the optical cavity with the help of a nitrobenzene Kerr cell. Results of a detailed theoretical study and some preliminary experimental results on the phase locking of modes in solid state lasers are given. These results show the existence of and the reasons for such phase-locking-effect. Results are reported on an attempt at obtaining single-mode operation of the YAG:ND^{3+} laser using the scheme suggested by Prokhorov, Burch, and Siegman. The results suggest that it is possible to achieve a single-mode operation with this scheme. Detailed results are given of a theoretical study on the shape of the resonant modes of the Fabry–Perot cavity of an oscillating solid state laser when the nonlinear spatial saturation effect is taken into account. Finally, a report is given of the results of a detailed study on the propagation of an intense light pulse through an optical medium. TAB

N66-30291# Lindo Co., East Chicago, Ind. Crystal Products Dept.
PRODUCTION ENGINEERING MEASURE FOR RUBY LASER RODS Quarterly Progress Report, 1 Oct.–31 Dec. 1965
M. K. Towne and B. H. Heise [1966] 20 p refs
(Contract DA-36-039-AMC-06168(E))
(QPR-2; AD-629170) CFSTI: HC $1.60/MF $0.50

The document reports progress toward improving the ruby crystal growth process for the manufacture of Range-finder laser rods. Engineering studies during the quarter were concentrated on the effects on individual variables. Definite relations between boule quality and standoff, boule diameters and gas ratios have emerged. Necessity for extended growth runs and repetition of many tests has caused the growth study to slip one and one-half months behind schedule but current use of shorter growth runs and introduction of an improved feeder six months ahead of schedule will compensate for this slippage. Improved control of the distance between burner and boule cap by an automatic photosensitive device has been extneded to both growth stations allocated for contract work. A continuous powder feed has been installed on one station and has operated satisfactorily. Evaluation of boules has been based primarily upon fringe pattern and passive beam divergence. Equipment for active laser testing is not yet available and is cause for a delay in shipment of Engineering Test Samples. Author (TAB)

N66-30510# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE GaAs SEMICONDUCTOR LASER
A. Moeschwitzer 24 Nov. 1965 11 p refs Transl. into ENGLISH from Radio und Fernsehen (Germany), no. 16, 1964 p 488–490
(FTD-TT-65-891/1+2+4; AD-624728) CFSTI: HC $1.00/MF $0.50

A brief review is presented on the emission process, electromagnetic waves, and emission radiation of a gallium arsenide semiconductor laser. Sketches are included on the band model of a semiconductor, emission process, distribution of the electron concentration on the p-n junction, and recombination radiation along the p-n junction; a semiconductor laser model shows a laser crystal and contact. It is pointed out that laser operation is based on recombination radiation of p-n junctions, and that the coherent oscillations are produced over an induced emission radiation with the aid of a resonator. R.U.

N66-30672# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.
TECHNIQUES FOR SUPER-MODE OSCILLATION Interim Engineering Report, 1 Dec. 1965–28 Feb. 1966
Russell Targ, B. J. McMurtry, J. M. Yarborough, and J. M. French [1966] 77 p refs
(Contract AF 33(615)-2884)
(IER-3; AD-633014) CFSTI: HC $3.00/MF $0.75

This report describes an experimental and theoretical program to determine the fundamental properties of the FM and super-mode lasers. These two techniques make it possible to obtain at a single frequency the full power of a high-power multimode laser without suffering the loss in power inherent in conventional approaches involving the suppression of modes. The work of this program is divided broadly between two main activities. The first is to obtain a more complete understanding of the physics governing the operation of the FM and super-mode lasers. The second is concerned with improving the techniques for coupling the modes of the FM laser and finding more efficient means for full power super-mode conversion of the FM signal to a monochromatic output. Author (TAB)

N66-30883# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MULTIPHOTON PROCESS INDUCED BY A LASER [PROCESSUS MULTIPHOTONIQUES PROVOQUES PAR UN LASER]
Pierre Nelson Dec. 1965 18 p refs In FRENCH
(CEA-R-2888; PB-169161) CFSTI: HC $1.00/MF $0.50

A theory on the quantum field relationship to the multiphotonic effects produced by a gas laser beam is presented. Specific equations are derived for numerical data obtained experimentally on a high-order, nonlinear, phenomenon involving a dozen photons. The following multiphotonic effects are described: Compton effect, bremsstrahlung, and photoelectric effect. The influence of collective effects are given for: experimental data, an ideal plasma, low frequencies, and dielectrics. Corrections are noted for very low frequencies, bandwidth, and beam aperture. It is concluded that experimental results express the data quantitatively. This finding is thought to constitute proof of the claim advanced in the theory. Transl. by R.Ll.

N66-31142# Air Force Cambridge Research Labs., Bedford, Mass.
A LASER FOR AN EARTH-BASED SATELLITE ILLUMINATOR
Robert L. Iliff Jun. 1965 23 p refs *Its* Instrumentation Papers No. 70
(AFCRL-65-442; AD-619342) CFSTI: HC $2.00/MF $0.50

A 250-joule, liquid-nitrogen cooled, ruby laser has been used to illuminate a specially equipped satellite, Explorer 22, with sufficient intensity to photograph the cube corner reflectors located on the satellite. The laser system including the photoreceiver is described. A simple method of aligning the optic axis with a known azimuth is presented. Some laser experiments designed to lengthen the lifetime of the laser and to optimize the output energy are also given. Author (TAB)

N66-31161*# Lafayette Coll., Easton, Pa.
DEVELOPMENT OF THE 10.6-MICRON LASER
Zbigniew D. Jastrzebski *In* NASA. Goddard Space Flight Center ASEE-Univ. of Md.-Catholic Univ. NASA Summer Fellowship Program Jan. 1966 p 95-96 (See N66-31154 17-07) CFSTI: HC $4.00/MF $0.75

Work was initiated on the development of a 10.6 micron nitrogen-carbon dioxide laser to be used in an optical tracking system for communication between the ground stations and the Echo II satellite. Two experimental setups, which, with respect to the Vycor discharge tube, differed in the mirror arrangement, were designed. In one setup the gold plated mirrors form an integral part of the laser assembly, being vacuum-tight connected to the ends of the discharge tube through metallic bellows. In the second the gold plated mirrors are located externally to the discharge tube, which is terminated by vacuum tight Brewster angle windows. These windows and one of the two gold plated mirrors are made of barium fluoride. This mirror has a one millimeter diameter hole in the gold coating for coupling out the radiation; the other mirror is one hundred percent opaque. The discharge tube is connected through an outlet with the manifold of the vacuum system so that it is possible to control precisely low partial pressures of the gaseous ingredients. Qualitative measures for the detection of the infrared laser beam were performed. D.T.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N66-30078*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
SHEAR MODULI OF BORON FILAMENTS
Harvey W. Herring and V. Gopala Krishna Washington, NASA, Jul. 1966 18 p refs
(NASA-TM-X-1246) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The shear moduli of boron filaments were determined by a dynamic torsion-pendulum method and a static torque-twist method. A detailed description of the equipment and techniques involved in the two experimental methods is included. Similar vapor deposition processes were used by two different manufacturers to produce the boron filaments used in the study. Overall diameters of the filaments ranged from 0.0017 to 0.0030 inch (43 to 76 μm) and the average shear modulus ranged from about 16×10^3 to 20×10^3 ksi (110 to 138 GN/m^2). Author

N66-30085*# LTV Aerospace Corp., Dallas, Tex.
BIAXIAL STRENGTH CHARACTERISTICS OF SELECTED ALLOYS IN A CRYOGENIC ENVIRONMENT Final Engineering Report, 6 Jan. 1965-6 May 1966
S. W. Mc Claren, C. R. Foreman, and J. F. Grabinski 6 May 1966 166 p refs *Its* Rept.-2-53420/6R-2279
(Contract NAS9-3873)
(NASA-CR-65412) CFSTI: HC $5.00/MF $1.00 CSCL 11F

The characteristics and mechanical properties of several metallic sheet materials subjected to uniaxial and biaxial stress fields at cryogenic temperatures are compared for state of stress and for temperature versus mechanical properties. Standard stress-strain curve data for uniaxial and 1:1 and 2:1 biaxial stress states are reported at room temperature, -105°F, -320°F, and -423°F. These data are compared with the deformation energy theory to illustrate the predictability of results. Program material ratings were accomplished while using biaxial strength/weight ratios, biaxial ductility, and fracture toughness as the prime rating factors. This research has generated cryogenic uniaxial and biaxial design data, investigated fracture mechanisms, developed uniaxial and biaxial creep data at -320°F, evaluated the efforts of stress states on weldments, compared results to an applicable failure theory, and considered practical design criteria concepts for pressurized components at cryogenic temperatures. Author

N66-30096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE CREEP OF AN ALUMINUM ALLOY UNDER A VARIABLE LOAD
V. S. Namestnikov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 180-194 refs (See N66-30086 17-23)

Results are presented for a major program of experimental investigation of aluminum alloy under a unidirectional extension. The study is directed toward behavior of metal under creep conditions with variable loads and the law-governing principles which it obeys. Author

N66-30117*# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.

PLANE STRAIN FRACTURE TOUGHNESS AND MECHANICAL PROPERTIES OF 5Al-2.5Sn ELI TITANIUM AT ROOM AND CRYOGENIC TEMPERATURES Final Report

Carl M. Carman, John W. Forney, and Jesse M. Katlin Apr. 1966 75 p refs

(NASA Order C-6860A)

(NASA-CR-54296; FA-R-1796) CFSTI: HC $3.00/MF $0.75 CSCL 11F

The suitability of 5Al-2.5Sn ELI titanium alloy for cryogenic tankage applications has been studied by determining the mechanical and fracture properties of the material at testing temperatures ranging from room temperature to −423°F, utilizing the specific heat of vaporization of liquid helium. Small round tensile specimens were developed to measure the tensile properties over the range of testing temperatures. Plane strain fracture toughness measurements were also made at these temperatures using the pop-in technique with a small notched bend specimen. The degree of preferred orientation in this alloy was qualitatively studied by determining the ratio of the width strain to the thickness strain. The fracture toughness values were interpreted in terms of the crystallography and mechanism of deformation of titanium. The data are summarized in terms of a part-through defect which will be stable at various operating temperatures and stress levels. It has been shown that texture hardening may be used to obtain high burst stresses under biaxial stress conditions.

Author

N66-30179*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INFLUENCE OF TIME ON VACUUM VAPORIZATION RATE AND SURFACE COMPOSITIONAL STABILITY OF TANTALUM CARBIDE-HAFNIUM CARBIDE SOLID SOLUTIONS ABOVE 2000°C

Daniel Deadmore Washington, NASA, Jul. 1966 18 p refs

(NASA-TN-D-3503) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The vaporization rates of TaC, HfC, and of solid solutions of 80TaC - 20HfC, 50TaC - 50 HfC, and 25TaC - 75HfC were determined gravimetrically as functions of heating times from 5 to 70 hr in vacuum at several temperatures between 2060 and 2600°C. After the samples were heated, they were examined by X-ray diffraction, electron probe, and microscopic methods. For the tests at 2600°C the sublimates were collected and chemically analyzed. Up to 2600°C only HfC vaporized congruently. All compositions containing TaC vaporized incongruently with preferential loss of either carbon or hafnium or both. In these materials the surface compositions changed, because the diffusion of the carbon and hafnium to the surface was not as rapid as their volatilization. These composition changes extended to considerable distances below the surface. At constant temperature the vaporization rate of all compositions containing tantalum decreased with time. This decrease in vaporization rate with heating time became less pronounced at higher temperatures. One explanation for the decrease in vaporization rate with time at constant temperature is that the carbon diffusion rate is less than the vaporization rate up to 2600°C.

Author

N66-30180*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COLD CONSOLIDATION OF METAL PLUS DISPERSOID BLENDS FOR EXAMINATION BY ELECTRON MICROSCOPY

Gustav Reinhardt, Walter S. Cremens, and John W. Weeton Washington, NASA, Jul. 1966 40 p refs

(NASA-TN-D-3511) CFSTI: HC $2.00/MF $0.50 CSCL 11F

The feasibility of high-energy-rate compaction as a means of consolidating powder blends used to prepare dispersion-strengthened alloys was investigated. The techniques produced samples of sufficient density (greater than 85 percent of theoretical density) to be examined with an electron microscope. An advantage of the methods studied is that consolidation was accomplished without application of high temperature, and thus agglomeration that might result through diffusion or chemical reaction may be avoided. Three techniques were investigated: a cartridge-actuated compaction press, a Dynapak press, and a direct-contact sheet explosive. The cartridge-actuated compaction press proved to be a practical laboratory apparatus that readily consolidated nickel-base blends. Hydrogen cleaning prior to consolidation and annealing of the consolidated specimens improved the particle contrast of the micrographs, apparently without causing appreciable agglomeration of the dispersoid. Particles as fine as 0.01 μ were discernible in the microstructures, which is within the range considered desirable for dispersion strengthening. A tungsten-base blend was also compacted with a slight modification of the cartridge-actuated compaction press. The Dynapak and the direct-contact sheet explosive methods also proved to be effective in consolidating powder blends.

Author

N66-30236# Laboratoires du Centre d'Etude de l'Energie Nucleaire, Mol (Belgium).

IMPERFECTIONS IN METALS. II: CORROSION AND OXIDATION Quarterly Report No. 11, 1 Apr.-30 Jun. 1965

Brussels, EURATOM, [1965] 24 p refs

(Contract EURATOM-054-64-4 TEEB)

(EURAEC-1457; EUR-2386; R-2355) CFSTI: HC $1.00/MF $0.50

Transmission electron microscopy of corrosion-oxidation films formed on both Van Arkel zirconium and Zircalloy-2 in air from 250° to 450°C and in water from 225° to 325°C showed that gross differences existed in the film morphology depending on the environment and surface preparation. Annealed Zr, oxidized in air, formed monoclinic zirconia films which replicated the metal grain structure but which also contained fine-grain regions, pseudo-amorphous areas, pustules, and preferentially oxidized grain boundaries. Etched Zr, oxidized under the same conditions, formed uniform films having only one heterogeneity, viz. preferentially oxidized twins. Oxidation of annealed Zr in water produced a high density of oxide nuclei (monoclinic oxide) on a single crystal monoclinic matrix. Longer oxidation produced pustules which were much more numerous than those formed by air oxidation. Zircaloy-2 generally formed more uniform films than Zr in both air and water and did not exhibit the preferential grain boundary oxidation so prevalent in Zr oxidation films. Annealed Zircaloy-2 formed mottled films, whereas etched Zircaloy-2 oxidized similarly, showed unmottled grains which were sharply delineated and which clearly showed local areas corresponding to the intermetallics.

NSA

N66-30237# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.

HIGH-TEMPERATURE TENSILE PROPERTIES OF SELECTED ALLOYS AFTER PROLONGED THERMAL EXPOSURE

F. A. Comprelli Feb. 1965 43 p refs

(Contract AT(04-3)-189)

(GEAP-4794) CFSTI: HC $2.00/MF $0.50

Data are presented in which are documented the tensile properties of selected superheat alloys at 75, 1100, and 1300°F.

The alloys include Incoloy-825, Inconel-718, Hastelloy-X, Hastelloy-F, Inconel-625, René-62, Incoloy-801, and Incoloy-800. The properties of each alloy were evaluated after exposure for periods up to 5000 hours at temperatures of 1000, 1100, 1200, and 1300°F. Author (NSA)

N66-30260*# Aerojet-General Corp., Sacramento, Calif.
PROPERTIES OF LARGE 7079 ALUMINUM ALLOY FORGINGS IN A CRYOGENIC ENVIRONMENT
F. T. Inouye Washington, NASA, Jul. 1966 92 p refs
(Contract NAS3-2555)
(NASA-CR-513) CFSTI: HC $3.00/MF $0.75 CSCL 11F

Large 7079-T652 hand forgings were evaluated for pump impeller and inducer applications in liquid oxygen/liquid hydrogen rocket engines. The results of mechanical property tests, reheat treatment experiments, and microstructural studies are presented. The application of 7079 alloy in a cryogenic environment is discussed based upon the test results, and recommendations are made for metallurgical analysis of the more promising alloys. Author

N66-30262# Emmanuel Coll., Boston, Mass. Research Language Center.
PRODUCTION OF MOLYBDENUM SINGLE CRYSTALS WITH ELECTRON-BEAM FLOATING ZONE MELT
Nay-ben Ming et al Bedford, Mass., AFCRL, Feb. 1966 14 p refs Transl. into ENGLISH from Wu-Li Hsueh Pao (Peking), v19, no. 3, 1963 p 160–164
(Contract AF 19(628)-5073)
(EMM-65-3; AD-632405) CFSTI: HC $1.00/MF $0.50

This paper describes an electron bombardment furnace made in China used to produce refractory metal single crystals. Molybdenum single crystals are prepared and examined, and techniques for the production are described. Microscopic examinations reveal numerous terraces on the surfaces of the molybdenum crystals. These terraces are tentatively identified as evaporation terraces. Author (TAB)

N66-30319# National Aero- and Astronautical Research Inst., Amsterdam (Netherlands).
CONSTANT LOAD AMPLITUDE AND PROGRAMME FATIGUE TESTS ON SINGLE LAP JOINTS IN CLAD 2024-T3 AND 7075-T6 ALUMINIUM ALLOY WITH TWO ROWS OF RIVETS OR HUCKBOLTS
A. Hartman, F. A. Jacobs and W. J. van der Vet [1964] 79 p refs Sponsored by Neth. Aircraft Develop. Board (NIV)
(NLR-TN-M.2147) CFSTI: HC $3.00/MF $0.75

Several single lap joints in clad 2024-T3 and 7075-T6 aluminum alloy with two rows of rivets or Huckbolts have been evaluated for fatigue strength properties, both in tests with constant load amplitude and in tests with a programmed load sequence based on a gust spectrum. Results showed that: (1) the replacement of aluminum alloy snap rivets and blind rivets of the same diameter decreased the endurance in the program tests approximately four times; (2) the Palmgren–Miner rule in general gave a conservative estimate of the endurance in the program tests; and (3) the grading orders of the different types of riveted joints as determined from the results of the constant load amplitude tests and the program tests showed moderate agreement. Author

N66-30365*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
SELF-LUBRICATING COMPOSITES OF POROUS NICKEL AND NICKEL–CHROMIUM ALLOY IMPREGNATED WITH BARIUM FLUORIDE–CALCIUM FLUORIDE EUTECTIC
Harold E. Sliney Washington, NASA, Jul. 1966 35 p refs Presented at Ann. Meeting of the Am. Soc. of Lubrication Engr., Pittsburgh, 2–5 May 1966
(NASA-TN-D-3484) CFSTI: HC $1.00/MF $0.50 CSCL 11F

The compressive yield strength of the nickel composites was quite low (about 30,000 psi); therefore, in order to avoid severe plastic deformation during the friction and wear experiments, it was necessary to employ moderate contact stresses. However, alloy composites were comparatively resistant to plastic deformation; the compressive yield strength was 78,000 pounds per square inch or about 75 percent of the strength of the age-hardened alloy in the dense, wrought form. In air at moderate contact stresses, the friction and wear properties of nickel composites were only slightly inferior to those of the alloy composites. Oxidation of nickel composites becomes serious at 1200°F, however, and limits the usefulness of this material in air to a maximum temperature of about 1100°F. The corresponding temperature limitation of the alloy composites in air was about 1350°F. In a hydrogen atmosphere, the alloy composites performed satisfactorily to 1500°F and may be suitable to somewhat higher temperatures. The frictional properties of the composites were significantly improved by the application of a thin, sintered coating of the eutectic fluoride to the bearing surfaces of the composites. Author

N66-30400*# North American Aviation, Inc., Los Angeles, Calif.
INVESTIGATION OF LONG-TERM EXPOSURE EFFECTS UNDER STRESS ON SUPERSONIC TRANSPORT STRUCTURAL ALLOYS
George Martin [1966] 111 p refs
(Contract NASw-921)
(NASA-CR-76151; NA-65-24) CFSTI: HC $4.00/MF $0.75 CSCL 11F

The report covers the first two phases of a 30,000-hour exposure test. Six materials—two titanium alloys, two PH steels, and two superalloys—were tested under stress in five environmental conditions comprising combinations of salt and braze coatings and constant and cyclic exposure at 650°F. Braze-coated titanium alloys, salt-coated titanium 8Al–1V–1Mo alloy and cyclically exposed AM 350 steel were the only alloys subject to stress-corrosion failure within the 20,000-hour exposure covered. In this period relative phase changes occurred in the titanium alloys without significant mechanical property changes and aging reactions occurred in both steels and the superalloys with appropriate mechanical property changes. A hypothesis for corrosion reactions on titanium alloys in salt environments has been developed. Author

N66-30410# Argonne National Lab., Ill.
A CONVECTIVE-DIFFUSION STUDY OF THE DISSOLUTION KINETICS OF 304 STAINLESS STEEL IN THE BISMUTH-TIN EUTECTIC ALLOY
T. F. Kassner Nov. 1965 39 p refs
(Contract W-31-109-ENG-38)
(ANL-6985) CFSTI: HC $2.00/MF $0.50

The kinetics of dissolution of type 304 stainless steel in the Bi–42 wt % Sn eutectic alloy were investigated under the

well-defined hydrodynamic conditions produced by the rotating-disc sample geometry. The experiments were carried out in the temperature interval of 200° to 1100°C at rotational speeds between 2 and 150 rpm. A convective-diffusion model was used to interpret the experimental data. The dissolution process was found to be liquid-diffusion controlled under specific conditions of temperature and Reynolds number. Author (NSA)

N66-30411# Argonne National Lab., Ill.
STUDIES OF STOICHIOMETRIC AND HYPERSTOICHIOMETRIC SOLID SOLUTIONS IN THE THORIA-URANIA SYSTEM Final Report
E. D. Lynch Dec. 1965 40 p refs
(Contract W-31-109-ENG-38)
(ANL-6894) CFSTI: HC $2.00/MF $0.50

Studies were made of the single-phase, solid-solution region of the thoria–urania system, including both stoichometric and hyperstoichiometric materials. The temperature range for formation of hyperstoichiometric solid solutions was determined and related to the decomposition of U_3O_8 through oxygen loss. The degree of nonstoichiometry was shown to be reproducible for any given composition and heat treatment. Changes in X-ray lattice parameters, due to stoichiometry, were determined. The stability of thoria–urania solid solutions was investigated by study of the oxidation characteristics and thermal-expansion analysis. The reduction of hyperstoichiometric materials to stoichiometry was accompanied by permanent dimensional changes that are related to oxygen loss.
Author (NSA)

N66-30420# Battelle-Northwest, Richland, Wash.
TRANSFORMATION RATES OF PLASTICALLY DEFORMED PLUTONIUM
R. D. Nelson Mar. 1966 14 p refs
(Contract AT(45-1)-1830)
(BNWL-203) CFSTI: HC $1.00/MF $0.50

Plastic deformation of the stable β-phase in Pu retards the $\beta \rightarrow \alpha$ transformation. This is consistent with known martensitic transformations. There are insufficient dislocations in plastically deformed α-phase Pu to retard the $\alpha \rightarrow \beta$ transformation, but sufficient dislocations are present to accelerate it. Deformed α-phase Pu can be annealed at 105°C.
Author (NSA)

N66-30554# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Division.
INVESTIGATION OF THE THERMODYNAMIC PROPERTIES OF THE TERNARY METALLIC SYSTEM Bi–Cu–Sb AT THE SECTION $N_{Bi}:N_{Sb}=1:1$ BY THE METHOD OF EMF
A. L. Lomov and A. N. Krestovnikov 29 Apr. 1966 11 p refs Transl. into ENGLISH from Zh. Prikl. Khim. (Moscow), v. 38, no. 1, 1965 p 188–192
(FTD-TT-65-1849/1+2+4; TT-66-61202; AD-632291) CFSTI: HC $1.00/MF $0.50

The study of the thermodynamic characteristics of the ternary liquid metallic fusions Bi–Cu–Sb with which there is preserved as unchangeable the ratio $N_{Bi}:N_{Sb}=1:1$ at 1215° K by the method of emf established that for the system there are characteristic negative deviations from Raoult's law, positive–negative heats, and positive excess entropies of mixing. The positive excess entropies of the mixing in the fusions studied are established in connection with the great difference in the atomic volumes of the components of the metallic pair Bi–Cu and Cu–Sb. Author (TAB)

N66-30567# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
DEFORMATION, CREEP, AND FRACTURE IN ALPHA-ZIRCONIUM ALLOYS
M. L. Picklesimer [1965] 59 p refs Presented at the Electrochem. Soc. Meeting, Buffalo
(Contract W-7405-ENG-26)
(ORNL-P-1753; CONF-651017-2) CFSTI: HC $3.00/MF $0.75

The anisotropy of mechanical properties observed in α-zirconium alloys can be related to the preferred orientation of the material. The influence of preferred orientation on anisotropy of yield strengths, plastic flow, creep, fracture, their strain rate and temperature sensitivities, and the stability of such textures to further deformation are discussed in terms of the deformation systems observed in single crystals. It was concluded that other deformation systems are forced to operate because of the restraint of neighboring grains in polycrystalline materials. 59 references are cited. Author (NSA)

N66-30568# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
VARIATIONS IN THE EMBRITTLEMENT OF IRRADIATED PRESSURE VESSEL STEELS, PART I
E. T. Wessel and T. W. Eichelberger 15 Jan. 1965 41 p refs
(Contracts AT(11-1)-GEN-14; NObs-78844)
(WERL-8844-4) CFSTI: HC $2.00/MF $0.50

The basic aspects of the deformation and fracture characteristics of several heats of ASTM A302B steel were investigated in terms of the Petch parameters. Both irradiation sensitive and insensitive were represented in the data that were analyzed. In the irradiated condition, the friction stress, σ_i, increased with increased neutron exposure for all heats. The sensitive heats exhibited a much greater increase in σ_i than did the insensitive heats. The grain boundary resistance, k_y decreased with increased exposure, particularly at the higher exposure levels ($>10^{18}$ nvt). The relative change in σ_i and/or k_y is the predominate factor controlling sensitivity to irradiation damage. It appears that the differences in σ_i and k_y and the corresponding bulk differences in irradiation sensitivity may be attributed to gross differences in microstructure. Author (NSA)

N66-30629# Martin Co., Denver, Colo.
CRYOGENIC MATERIALS DATA HANDBOOK Progress Report No. 3
F. R. Schwartzberg, S. H. Osgood, R. D. Keys, and T. F. Kiefer Wright-Patterson AFB, Ohio, AF Mater. Lab., Mar. 1966 232 p refs Suppl. to ML-TDR-64-280
(Contract AF 33(657)-9161)
(PB-171809, Rev., Suppl. 3; ML-TDR-64-280; AD-633388) CFSTI: HC $6.00/MF $1.25

A cryogenic materials handbook of fracture toughness data for a variety of metals down to −423°F is presented. The fracture mechanics concept is utilized in a stress analysis approach to the problem of brittle fracture. This involves the amount of strain energy available and released in initiating and maintaining fast fracture. The bulk of the data deals with room temperature behavior of high-strength materials, such as heat treated alloy steels and titanium alloys. C.T.C.

N66-30652# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
FRACTURE TOUGHNESS EVALUATION OF TITANIUM, ALUMINUM, AND STEEL

John W. Forney Mar. 1966 16 p refs
(M-66-20-1; AD-632926) CFSTI: HC $1.00/MF $0.50

The plane strain fracture toughness of 2014-T6 aluminum alloy, 6Al–4V titanium alloy, and 4340 steel has been investigated at room temperature and at −75° F, using the single edge notched specimen. Data for the 2014-T6 aluminum alloy, 6Al-4V titanium alloy, and 4340 steel, quenched and tempered to Rockwell C 50 hardness, showed the plane strain fracture toughness to be insensitive to testing temperature. The specimens of 4340 steel, quenched and tempered to Rockwell C 30 hardness, were too small for accurate plane strain fracture toughness values, but the results indicate that no transition occurred over the range of testing temperature investigated. The cycle-annealed specimens of 4340 steel indicated a sensitivity of plane strain fracture toughness to testing temperature. These data show the superiority of the quenched and tempered structure to mixed structure, even though both are at the same hardness level. Author (TAB)

N66-30667# United Aircraft Corp., East Hartford, Conn. Research Labs.
INVESTIGATION OF THE CREEP, FATIGUE, AND TRANSVERSE PROPERTIES OF Al_3Ni WHISKER AND $CuAl_2$ PLATELET REINFORCED ALUMINUM Final Report, 12 Apr. 1965–11 Apr. 1966
M. J. Salkind, F. D. George, F. D. Lemkey, and B. J. Bayles 11 May 1966 94 p refs
(Contract NOw-65-0384-d)
(E910344-4; AD-633241) CFSTI: HC $3.00/MF $0.75

Al_3Ni whisker reinforced aluminum was found to exhibit lower minimum creep rates and longer creep life than $CuAl_2$ lamellar reinforced aluminum. The creep behavior of the whisker composite was characterized as having a small minimum creep rate and a rapid period of tertiary creep with a small amount of rupture ductility. The lamellar composite, on the other hand, was found to exhibit a large amount of tertiary creep and rupture ductility. The resistance to creep deformation was found to be significantly greater for Al–Al_3Ni solidified at 11 cm/hr than that solidified at 2 cm/hr. The microstructure of Al–Al_3Ni after creep testing was found to be essentially unchanged by the combined effects of stress and temperature. A small amount of spheroidization was noted only in localized areas where severe plastic deformation occurred. The low cycle fatigue behavior of Al–$CuAl_2$ was found to be superior to that of Al–Al_3Ni. It is postulated that a lamellar reinforcement is more efficient at blocking lateral plastic flow than a rod-like reinforcement. The low cycle fatigue life of Al–Al_3Ni was found to be inversely proportional to the square of the strain amplitude. Author

N66-30706# Frankford Arsenal, Philadelphia, Pa. Pitman-Dunn Research Labs.
THE INFLUENCE OF ENVIRONMENT ON THE CRACK PROPAGATION CHARACTERISTICS OF HIGH STRENGTH ALUMINUM ALLOYS
Joseph H. Mulherin Apr. 1966 27 p refs
(R-1809; AD-632988) CFSTI: HC $2.00/MF $0.50

The stress-corrosion behavior of four alloys of aluminum was investigated. Using cantilever-loaded fatigue-cracked specimens, the crack propagation characteristics of 7178-T6, 2014-T6, 2024-T351, and 7075-T6 aluminum alloys were determined. The aqueous environments used were: immersion in distilled water, constant immersion in 3-1/2 percent sodium chloride, and alternate immersion in salt solution and air. The results are interpreted in terms of fracture mechanics parameters. Where susceptibility to stress-corrosion exists, the rate of crack propagation is dependent upon stress intensity and environment. A method is also presented to obtain threshold values of stress intensity for stress-corrosion attack with minimal experimental effort. Results are compared to those of other testing methods. Author (TAB)

N66-30743# Naval Ordnance Lab., White Oak, Md.
LOW TEMPERATURE DEFORMATION OF THE TiNi INTERMETALLIC COMPOUND
A. G. Rozner and W. J. Buehler 1 Mar. 1966 20 p refs
(NOLTR-66-38; AD-633220) CFSTI: HC $1.00/MF $0.50

The effect of cold working on room temperature mechanical properties of TiNi intermetallic compound was investigated. Samples were cold worked at temperatures well below their martensitic transformation temperature, by means of conventional metal working techniques. The low temperature ductility is ascribed to a martensitic transformation and enables deforming the TiNi compound at low temperatures where the work hardening rate is very high. The martensitic transformation in TiNi is promoted by application of external forces and the TiNi-martensite exhibits high strength and ductility at room temperature. The low temperature deformation increases the room temperature yield strength of stoichiometric TiNi from 18,000 to 61,000 psi and the ultimate tensile strength from 125,000 to 220,000 psi while preserving an elongation of 15 percent. Author (TAB)

N66-30771# Los Alamos Scientific Lab., N. Mex.
CORROSION TEST OF HASTELLOY N, INCONEL 600, AND Hymu-80 EXPOSED TO UCl_3–KCl AT 900°C
B. J. Thamer 4 Feb. 1966 14 p refs
(Contract W-7405-ENG-36)
CFSTI: HC $1.00/MF $0.50

Static, isothermal tests up to 84 days in length were performed in the UCl_3–KCl eutectic of the highest uranium concentration at 900°C. The maximum penetration in any case was approximately 2 mils. The corrosion was impeded by a metallic reaction layer, the composition of which was principally uranium and nickel. Author (NSA)

N66-30772# Oak Ridge National Lab., Tenn.
A BIBLIOGRAPHY ON TRACER DIFFUSION IN METALS: PART I. SELF-DIFFUSION IN PURE METALS. PART II. IMPURITY DIFFUSION IN PURE METALS Supplement to Parts I and II
John Askill, comp. Jun. 1966 12 p refs
(Contract W-7405-ENG-26)
(ORNL-3795) CFSTI: HC $2.00/MF $0.50

Frequency factors and activation energies for self-diffusion in pure metals have been compiled from the literature reported between 1938 and 1964. An author index is included. (142 references.) Author (NSA)

N66-30781# Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. ISOTHERMAL OXIDATION OF HASTELLOY X AT 1750 AND 1850°F IN AIR
R. M. Baciarelli Dec. 1965 41 p refs
(Contract AT(10-1)-880)
(AGN-TM-413) CFSTI: HC $2.00/MF $0.50

The oxidation properties of Hastelloy X when exposed in air at 1750° and 1850°F were studied using a continuous weight change recording apparatus. Samples of 1.9 and 0.07 wt % Co Hastelloy X tubing were exposed simultaneously for 5456 hr at 1750°F and similar samples were exposed simultaneously at 1850°F for 4000 hr. It was found that the low-cobalt Hastelloy X had a higher scaling rate but behaved more consistently than the high-cobalt alloy when thermal cycled from 1850°F. In this temperature range, the oxidation penetrations in the low-cobalt alloy were less severe than those observed in the high-cobalt alloy. Oxidation penetration in the high-cobalt material occurred, predominantly, in an intergranular manner and an M_6C band depleted in carbides was observed which was not present in low-cobalt alloy. The oxidation penetration of both alloys increased by about 80% when the temperature was raised from 1750° to 1850°F and a general softening occurred. This was more pronounced in the high-cobalt alloy. Two oxides, Mn_3O_4 and Cr_2O_3 were formed as spallation products and a greater amount of Mn_3O_4 was formed in the latter stages of oxidation than in the early stages. The experimental data indicate that the activation energy (Q) is not temperature dependent but is dependent upon the alloy composition and that the oxidation rate constant (k) is temperature dependent. The oxidation curves developed from the data have an exponential temperature dependency and a cubic time dependency, indicating that the oxidation is occurring at a rate less than that predicted by diffusion theory, probably as a result of the diffusion of more than one component. Author (NSA)

N66-30809# Oak Ridge National Lab., Tenn. Health Physics Div.

STUDIES OF COLLECTIVE ELECTRON OSCILLATIONS IN METALS BY OPTICAL METHODS

E. T. Arakawa, R. N. Hamm, W. F. Hanson, and T. M. Jelinek [1964] 23 p refs Presented at Intern. Conf. on Optical and Electron. Properties of Metals and Alloys, Paris

(Contract W-7405-ENG-26)

(ORNL-P-1600; CONF-650424-2) CFSTI: HC $1.00/MF $0.50

Reflection of photons from opaque solids and photon emission from electron-bombarded thin films were investigated to determine the plasma frequencies of free electrons in various metals, e.g., Al, Cd, Tl, and Zn. The energy loss functions for volume and surface plasmons were calculated from the optical constants determined from reflectivity measurements, and were compared with the results obtained in energy-loss experiments. Unambiguous identification of the plasma losses was made possible by a knowledge of the optical constants, since these losses arise at frequencies where certain types of peaks are found in the energy loss functions. Studies of photon emission from electron-bombarded thin films give information not only on the volume plasma frequency, but also on lifetimes of the plasma oscillations due to radiation and to electronic damping. Author (NSA)

N66-30816# Oak Ridge National Lab., Tenn.

INFLUENCE OF TRACES OF LEAD AND RARE EARTHS ON THE STRUCTURE AND MECHANICAL CHARACTERISTICS OF STAINLESS STEEL

P. Ravizza and W. Nicodemi [1965] 16 p Transl. into ENGLISH from Rev. Met. (Paris), v. 62, no. 4, 1965 p 351–357

(ORNL-TR-922)

By means of a hot crushing test, the hot working properties of a high purity steel were determined as a function of traces of lead and rare earths. The influence of this group of elements on certain mechanical characteristics of this type of steel was also investigated. It was found that increasing contents of lead can be correlated with a difference in hardness between the center and the boundary of the austenitic grain. The influence of an addition of rare earths on this hardness difference was also observed. Variation in shape and surface of the austenitic grain due to the presence of lead and rare earths was examined after hot working. Some hypotheses are proposed which explain the technological behavior of the steel on the basis of micrographic studies. Author (NSA)

N66-30890# Atomics International, Canoga Park, Calif.

LARGE SGR CREEP ACCELERATION TEMPERATURES

R. Todd 21 Apr. 1965 10 p refs

(Contract AT(11-1)-GEN-8)

(NA-SR-Memo-11433) CFSTI: HC $1.00/MF $0.50

Three possible bases or creep equations for determining the accelerated creep test temperature were investigated. Two of these laws are based on empirical data alone and are basically curve fitting equations applied to available creep rate data for 304 stainless steel. The third equation is based on activation energy principles and the results it produces are not derived from empirical data. Author (NSA)

N66-30942# California Univ., Berkeley. Lawrence Radiation Lab.

STRUCTURES AND STRENGTH OF AUSFORMED STEELS

Om Johari (Ph.D. Thesis) Jan. 1965 117 p refs

(Contract W-7405-ENG-48)

(UCRL-11861) CFSTI: HC $4.00/MF $0.75

Substructures of conventional and ausformed steels were examined using transmission electron microscopy to determine the causes of strengthening of these steels and to better understand the role of the parameters of ausforming. Steels based on Fe–25% Ni–0.3%C, with carbide forming alloying elements (Cr, V, and Mo) were examined in both austenitic and martensitic conditions. Undeformed steels were studied and compared with steels ausformed 8 and 30% at 100°C and 500°C. Dark field analyses were done in most cases to study substructural features such as precipitates and twinning. Precipitates and a high density of dislocations were observed in austenites and martensites of all 30% ausformed steels. A critical amount of ausforming was necessary to nucleate the precipitates and this amount was between 8 and 30% in all the steels examined. The precipitates are identified as Fe_3C, VC, MoC and probably $Cr_{23}C_6$. For the steels containing carbide formers, neither the precipitates could be grown nor the dislocation density reduced by low temperature tempering in the microscope. Similar treatments produced extensive growth of cementite in Fe–Ni–C steel. Two temperatures of deformation and different compositions of the steels showed little substructural differences. The higher strength resulting from ausforming is primarily due to the increased dislocation density. The precipitates play an important role by providing sites for dislocation multiplication and pinning. The role of carbon and strengthening was mainly through providing precipitates. No systematic variation of martensite plate sizes with ausforming parameters could be detected. The extent of twinning in martensites decreased with increasing amount of ausforming. This suggested that the occurrence of transformation twinning was favored by a low Ms temperature. Twinning in some austenites was observed. This may be due to the effects of solutes in lowering and stacking fault energy. The absence of twinning and high density of dislocations probably accounts for the better ductility of ausformed steels. It is proposed that explosive deformation of ausformed steels, alloying and ausforming to give deformable

precipitates, and explosive deformation of dispersion hardened materials containing suitable precipitates be investigated further to obtain materials with higher strength and better ductility. Author (NSA)

N66-30954# Iowa State Univ. of Science and Technology, Ames.
INTERPLANAR ANGLES AND PLANAR SPACINGS OF FIFTEEN TYPES OF PLANES FOR hcp YTTRIUM
B. G. Koepke and T. E. Scott Mar. 1966 70 p
(Contract W-7405-ENG-82)
(IS-1337) CFSTI: HC $3.00/MF $0.75

A computer program in Fortran II language for the crystallographic angles in hcp yttrium was processed and the data tabulated. The data include 15 types of planes and all their equivalent planes, or a total of 109 sets of Miller–Bravais indices. Relevant d-spacings and an (0001) standard projection are also included. Author (NDA)

N66-30967# Pittsburgh Univ., Pa.
A METALLOGRAPHIC AND X-RAY STUDY OF THE MgO $\cdot Al_2O_3$-UO_2 SYSTEM
Bernard Friedman Rubin (M.S. Thesis) 1966 56 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-T-1581) CFSTI: HC $3.00/MF $0.50

An investigation on the MgO$\cdot Al_2O_3$ system showed that the phase diagram is a eutectic type with limited terminal solubility. The eutectic temperature is about 2000°C while the eutectic composition is about MgO$\cdot Al_2O_3$–40 mole % UO_2. Below 1675°C, UO_2 and spinel are present in proportions related to their concentrations. Above this temperature range, certainly at 1750°F, alumina is precipitated from spinel, with UO_2, MgO$\cdot Al_2O_3$ appearing concurrently. UO_2 apparently catalyzes the vaporization of MgO, depleting the spinel in this component and thereby reducing its ability to retain Al_2O_3 in solution at 1750°F. The limited solubility of spinel for Al_2O_3, after MgO dissociation, is in keeping with published diagrams of the MgO–Al_2O_3 binary system. The critical temperature for MgO vaporization is within the limits of 1675°–1750°C. The structural instability of this mixture at high temperature precludes its use in power reactors operating above this temperature. Author (NSA)

N66-30970# Pennsylvania State Univ., University Park. Mineral Industries Experiment Station.
THE STRESS CORROSION SUSCEPTIBILITY OF HIGH STRENGTH STEELS Final Report
John H. Hoke Jun. 1965 65 p
(Contract AT(30-1)-3257)
(NYO-3257-1) CFSTI: HC $3.00/MF $0.75

A study was made of stress-hydrogen cracking problems for type 410 stainless steel. The results show that a general correlation exists between resistance to stress hydrogen cracking and notch sensitivity. However, considerable variability in behavior is possible in apparently similar materials and direct conversion of impact data to stress-hydrogen cracking susceptibility is not reliable. Thermal treatments which increase fracture toughness also increase resistance to stress-hydrogen cracking. High-purity vacuum-melted alloys have much higher resistance to stress hydrogen cracking than commercial air-melted alloys. The specific ingredients present responsible for such degradation are not known, but general steel making alloy additions may contribute in part. NSA

N66-30972# Pratt and Whitney Aircraft, Middletown, Conn.
THE COMPATIBILITY OF COMPACTED BORON CARBIDE IN STAINLESS STEEL–ALKALI METAL SYSTEMS
C. J. Lymperes and H. Slotnick 27 Jul. 1965 10 p
(Contract AT(30-1)-2789)
(TIM-822) CFSTI: HC $1.00/MF $0.50

Specimens of boron carbide were exposed to 1000°F NaK-78 for extended times exceeding 5000 hours. Results of tests indicate the strong likelihood that the carbide would fragment in 1000°F NaK-78. It was noted that the fragments could be retained by 20 and 160 micron sintered metal filters. Fragmentation is attributed to the reaction between potassium and free carbon. Although boron and carbon transfer occurred, reaction between boron carbide and type 316 in NaK-77 was not detrimental. Author (NSA)

N66-30985# California Univ., Livermore. Lawrence Radiation Lab.
CONTRIBUTION TO THE STUDY OF THE PRESSURE-TEMPERATURE DIAGRAM OF PURE BERYLLIUM
Dec. 1965 31 p refs Transl. into ENGLISH of the French paper presented at the Intern. Conf. on the Met. of Beryllium, Grenoble, France, 16–20 May 1965
(UCRL-TRANS-1299(L); CONF-650508-3)

Below the $\alpha \rightarrow \beta$ transformation of beryllium, a plateau is observed in the curve of resistivity as a function of temperature. This is attributed to the recrystallization of the specimen following the severe deformation brought about by applying pressure to it in the solid state. The first experimental results obtained enable the plotting of a provisional pressure–temperature diagram for beryllium. From this diagram, the enthalpy of the $\alpha \rightarrow \beta$ transformation, at atmospheric pressure, is established at about 1.8 kcal/mole, while the increase in volume on melting is about 10%. Author (NSA)

N66-30991# Oak Ridge National Lab., Tenn.
DESIGN AND EVALUATION OF SPECIAL PURPOSE HIGH-VACUUM HIGH-TEMPERATURE EQUIPMENT FOR REFRACTORY-METAL RESEARCH
D. T. Bourgette Apr. 1966 73 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1426) CFSTI: HC $1.00/MF $0.50

Three pieces of special purpose equipment capable of 2000° C and at least 10^{-9} torr at room temperature were designed, fabricated, and evaluated for their use in metallurgical studies on refractory alloys. This equipment includes a quenching apparatus, continuous duty tantalum resistance furnace, and an apparatus in which creep studies could be conducted in tension or cantilever bending. The design features, temperature-pressure evaluations, and cost data are discussed. Author (TAB)

N66-30995# Denver Research Inst., Colo.
STUDIES OF THE EFFECT OF INTERSTITIAL ADDITION ON THE PHASE EQUILIBRIA OF THE NIOBIUM-RICH REGION OF THE NIOBIUM–TUNGSTEN–HAFNIUM AND NIOBIUM–TUNGSTEN–ZIRCONIUM ALLOY SYSTEMS Quarterly Progress Report No. 6, 1 Dec. 1965–28 Feb. 1966
Albert S. Yamamoto Mar. 1966 11 p refs
(Contract AT(11-1)-1092)
(DRI-1092-229) CFSTI: HC $1.00/MF $0.50

The effects of small carbon and oxygen additions on the phase equilibria of the niobium-rich region of the niobium–tungsten–hafnium and niobium–tungsten–zirconium alloy

systems was investigated. Metallographic examination of the alloys annealed at 1600°C and 1300°C (2912° and 2372°F) revealed that small oxygen additions to the niobium–tungsten–hafnium alloys resulted in formation of precipitates which were identified to be HfO_2 by the X-ray method. In the niobium–tungsten–zirconium alloys containing more than 10 wt % Zr and small quantity of oxygen, the presence of α-Zr was found by the X-ray diffraction method. The precipitates observed in the alloys that were high in tungsten and low in zirconium, however, were not identified. The powder X-ray data for a series of the selected oxygen-containing niobium–tungsten–hafnium and niobium–tungsten–zirconium alloys are tabulated. Author (NSA)

N66-30996# California Univ., Livermore. Lawrence Radiation Lab.

ELECTRON BEAM DISTILLATION FURNACE FOR REACTIVE METALS: DESIGN CONSIDERATIONS AND OPERATING EXPERIENCE

R. F. Bunshah and R. S. Juntz 13 May 1965 30 p refs Presented at the Vacuum Met. Conf., New York, 21–23 Jun. 1965
(Contract W-7405-ENG-48)
(UCRL-12487; CONF-650617-2) CFSTI: HC $2.00/MF $0.50

Electron beam distillation is a highly attractive technique for purification and simultaneous deposition to semi-finished shape (e.g., sheet) for the reactive metals Be, Ti, etc. A description is given of design considerations and operating experience with an electron beam distillation furnace. Distillate contamination sources and methods to minimize them are discussed. The production of titanium sheet is described. The distillate has 100% theoretical density. Microstructure, chemical analysis, and tensile properties of the distillate are given. Author (NSA)

N66-31036# California Univ., Livermore. Lawrence Radiation Lab.

PLUTONIUM AND URANIUM AS ENGINEERING MATERIALS

Charles R. Henry 26 Feb. 1965 17 p refs
(Contract W-7405-ENG-48)
(UCRL-12427) CFSTI: HC $1.00/MF $0.50

A review of current design possibilities using Pu and U and their principal alloys as materials in engineering design is presented. Mechanical and physical properties are summarized. Fabrication and joining techniques are presented, including forging, plating, machining, and welding. Also discussed are the peculiar difficulties and hazards of packaging and handling assemblies containing these materials. Author (NSA)

N66-31037# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.

APPLICATION OF STEREO ELECTRON METALLOGRAPHY TO DETERMINATION OF CRYSTAL ORIENTATION

R. M. Haines 16 Dec. 1965 11 p refs
(TRG-1161) HMSO: 2s 6d

The angular relation between the crystallographic faces of grain boundary holes, formed at elevated temperature in an irradiated material (beryllium) during slow strain to rupture, were measured stereoscopically on electron micrographs. The results show that the orientation of the holes, and thus of the adjacent matrix, can be determined to better than 5°. They also confirm that the holes themselves are practically equiaxed. The method suggests itself as a possible way of measuring grain boundary orientations and relative surface energy relation for other materials after suitable treatment to induce cavitation, provided that their low-temperature fracture characteristics are suitable for revealing the grain boundary holes. Author (NSA)

N66-31041# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.

INVESTIGATION OF THE APPLICABILITY OF THE BIAXIAL BRITTLE FRACTURE TEST FOR DETERMINING FRACTURE TOUGHNESS Final Summary Report

E. T. Wessel and W. H. Pryle Aug. 1965 29 p refs
(Contract NObs-78844)
(WERL-8844-11) CFSTI: HC $2.00/MF $0.50

The biaxial brittle fracture specimens, now designated as the wedge-opening-loading (WOL) specimens, was found to be applicable for plane-strain fracture toughness measurements (K_{IC}) in 3 lots of A302B steel. Three specimen sizes, 1, 2, and 4 in. thick, were tested over a range of temperatures from −320° to 200°F. The temperature range in which valid K_{IC} data is obtained is dependent upon the material and the specimen size. The results indicate that larger specimens (>4 in. thick) will be required to obtain valid data at ambient temperatures in typical materials. The investigation contributed substantially to advancing the state-of-the-art, and the WOL specimen has demonstrated considerable potential for fracture toughness testing of these low-strength, moderate-toughness materials. Author (NSA)

N66-31050# General Electric Co., Cincinnati, Ohio. Nuclear Materials and Propulsion Operation.

THE ENERGY AND ENTROPY OF VACANCY FORMATION IN BODY-CENTERED CUBIC REFRACTORY METALS

M. Hoch 24 Nov. 1965 8 p refs
(Contract AT(40-1)-2847)
(GE-TM-65-12-2; TID-22851) CFSTI: HC $1.00/MF $0.50

The heat and entropy of formation of vacancies in the bcc refractory metals Cr, Nb, Mo, and W were evaluated from calorimetric data. The heat of formation data are in fair agreement with values deduced from transient specific heat techniques. The entropy of formation was much smaller (6.5 eu), than those obtained from transient techniques, giving a pre-exponential term in the expression for the concentration of vacancies, 10 times smaller. Author (NSA)

N66-31057# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.

BIAXIAL STRAIN FATIGUE OF ZIRCALOY-4. PART A: EXPERIMENTAL AND ANALYTICAL TECHNIQUES

R. E. Schreiber Oct. 1965 70 p ref
(Contract AT(30-1)-3269)
(WCAP-3269-42A) CFSTI: HC $3.00/MF $0.75

The testing procedures that were used in the study of strain fatigue in biaxially stressed Zircaloy-4 at 715°F are described. Author (NSA)

N66-31065# Rocky Flats Div., Dow Chemical Co., Golden, Colo.

THE CORROSION OF UNALLOYED AND ALLOYED PLUTONIUM IN MONOBROMOBENZENE AND FREON-113 FLUOROCARBON

M. R. Dringman 14 May 1965 5 p
(Contract AT(29-1)-1106)
(RFP-744) CFSTI: HC $1.00/MF $0.50

The specimens were exposed for 26, 72, and 140 hr at 25°C. For the 26-hr period, monobromobenzene was 2.5 times more corrosive to the unalloyed Pu and 2 times more corrosive to the Pu-1 Ga alloy than the Freon-113. NSA

N66-31070# Oak Ridge National Lab., Tenn.
A STUDY OF LEAD AND LEAD-SALT CORROSION IN THERMAL-CONVECTION LOOPS
G. M. Tolson and A. Taboada Apr. 1966 18 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1437) CFSTI: HC $1.00/MF $0.05

Thermal-convection loop tests of several structural alloys were operated using circulating molten Pb. Screening tests were run to evaluate Croloy 2-1/4, ASTMA-106 carbon steel, AISI-type 410 stainless steel, and Nb–1%Zr. Two of the test loops contained surge tanks in which fluoride salts, Nb–1% Zr alloy, and graphite were placed in contact with the Pb to determine the compatibility of these materials in a direct-cooled lead system. All of the steel loops tended to plug in the cold regions because of formation of dendritic crystals of Fe and Cr. The hot-leg attack consisted of general surface removal with a few large pits extending to a greater depth. The Nb–1% Zr alloy showed no measurable attack; however, Nb crystals were found in the cold leg of a loop which operated 5000 hr at 1400°F with a ΔT of 400°F. Author (NSA)

N66-31092# Ohio State Univ. Research Foundation, Columbus.
MICROTOPOLOGY OF STRESS CORROSION CRACKING
T. J. Smith and R. W. Staehle Mar. 1966 14 p refs Presented at the 3d Intern. Conf. on Metallic Corrosion, Moscow, May 1966
(Contract AT(11-1)-1319)
(COO-1319-36; CONF-660514-1) CFSTI: HC $1.00/MF $0.50

Thin films of four iron–nickel–chromium base alloys were examined in the electron microscope, exposed to boiling $MgCl_2$, and examined again. Compositions were as follows (atomic per cent): Fe–15Ni–20Cr, Fe–15Ni–20Cr–1.5Si, Fe–15Ni–20Cr–0.1N, Fe–45Ni–20Cr. Each alloy was treated to obtain structures in the annealed, strained, and aged condition. Examination of specimens exposed to boiling $MgCl_2$ showed that stress exerts an important influence on the mode of cracking. In the absence of stress, attack tended to take the form of pitting; whereas, with stress the attack was highly oriented with the pitting being aligned in parallel crystallographic directions. The alloy containing phosphorus exhibited pitting having definite geometric shapes. Defect structure in the thin films appeared to have little correlation with established trends in cracking susceptibility nor with the mode of dissolution of thin films. Author (NSA)

N66-31139# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SECONDARY ELECTRONIC EMISSION OF COPPER AND OF CERTAIN COATINGS
D. B. Diatroptov 30 Mar. 1966 13 p refs Transl. into ENGLISH from Akad. Nauk SSSR Fiz. Lab., Elektron. Bol'shikh Moshchnostey, no. 2, 1963 p 148–156
(FTD-TT-65-1539/1+2+4; AD-631855) CFSTI: HC $1.00/MF $0.50

Measured was the coefficient of secondary electronic copper emission, of kupalloy and beryllium bronze under vacuum conditions, characteristic for large separable electro-vacuum installations with vapor-oil pumps and rubber packings. Examined was the effect on secondary emission of electronic and ionic bombardment and a series of chemical and mechanical surface machinings. Measurements were carried out with the aid of an ordinary electrostatic unit. A tantalum strip serves as the cathode with thorium oxide, spot applied against the opening in the focusing electrode. The installation was placed in a sectional steel vacuum chamber, which is evacuated by an oily diffusion pump with nitrogen traps. Beam voltage and the primary and secondary electron currents are registered on a multiple point self-recording potentiometer, allowing one to remove dependence graphs of the secondary electronic emission coefficient. TAB

N66-31145# National Academy of Sciences—National Research Council, Washington, D. C. Materials Advisory Board.
EVALUATION TEST METHODS FOR BERYLLIUM
Mar. 1966 65 p refs
(Contract ARPA SD-118)
(MAB-205-M; AD-631183) CFSTI: HC $3.00/MF $0.75

The report was prepared to establish standardized methods and procedures for conducting mechanical property tests on beryllium. The data presented are restricted to information which is well established and accepted, but the report also identifies areas of testing controversy and highlights current technical needs in the testing area. The report attempts to document recommended methods, based on a review of the procedures used in a number of organizations. For various reasons, many will want to deviate from these methods. To permit reliable inter-comparisons between laboratories, standardized methods are needed; and it is hoped that for this reason these methods will be adopted. Recommended procedures for tensile, 3-point bend, 4-point bend and precision elastic limit tests are described. Author (TAB)

N66-31169# Titanium Metals Corp. of America, New York.
DEVELOPMENT OF A STABLE-BETA TITANIUM ALLOY Tenth Quarter Report, 1 Oct.–31 Dec. 1964
D. B. Hunter [1964] 28 p refs
(Contract DA-30-069-ORD-3743)
(WAL-TR-405/2-9; AD-623600) CFSTI: HC $1.00/MF $0.50

Evaluation of ageable beta alloys Ti-17V-2Fe-2Co-3Al, Ti-17V-7 .5Co-3Al and Ti-8Mo-8V-5Co-3Al continued with room and elevated temperature smooth and notched tensile tests, creep stability, oxidation and stress-corrosion tests. Ti-17V-7 .5Co-3Al aged more rapidly than Ti-8Mo-8V-5Co3Al; after aging for 8 hours at 900°F, Ti-17V-7 .5Co-3Al had a yield strength of 198,000 psi, whereas that of Ti8Mo-8V-5Co-3Al was only 158,000 psi. In smooth and notched tensile tests at 600°F, Ti-17V-7.5 Co-3Al displayed more strength than Ti-8Mo-8V-5Co-3Al because of its faster aging response in a given time. However, in creep stability tests and oxidation tests, Ti-8Mo-8V-5Co-3Al was the better alloy. Stress corrosion tests performed upon all five ageable beta alloys developed in this project showed that, in the annealed condition, Ti-8Mo-8V-2Fe-3Al was the most resistant to stress corrosion and Ti-17V-7 .5Co-3Al and Ti-8Mo-8V-5Co-3Al the most susceptible. Author (TAB)

N66-31176# Massachusetts Inst. of Tech., Cambridge.
INVESTIGATION OF SOLIDIFICATION OF HIGH-STRENGTH STEEL CASTINGS Interim Report, Oct. 1, 1963–Sep. 30, 1964
R. V. Barone, H. D. Brody, and M. C. Flemings [1964] 84 p refs
(Contract DA-19-020-AMC-5443(X))
(AMRA-CR-64-04/3; AD-624987) CFSTI: HC $3.00/MF $0.75

A numerical technique was employed to compute microsegregation in alloys in which (a) the final solidification temperature and composition is variable, and (b) substantial diffusion occurs in the solid during and after solidification. In iron-26 percent nickel alloy, segregation ratio obtained is from 1.15 to 1.28 depending on solidification conditions. These results are in qualitative agreement with theory. Dendrite morphology was examined in iron–nickel alloys containing from 10 to 26 percent nickel, and in iron–nickel–carbon alloys containing about 26 percent nickel and up to 0.42 percent carbon. 'Cellular' structures result in the alloys studied under conditions of low solute content and high cooling rate. Lower cooling rates and higher solute contents produce a more complex dendrite structure, with secondary and tertiary branching. Primary dendrite arm spacing in the ingots studied ranged from about 40 to 700 microns, depending on alloy analysis and cooling rate. Dendrite arm spacing in the alloys studied generally increase with (a) decreasing cooling rate, (b) increasing nickel content (at least in the range of 15 to 26 percent nickel, and (c) carbon additions. Author (TAB)

N66-31228*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

TECHNICAL APPLICATIONS FOR OXIDE-DISPERSION STRENGTHENED MATERIALS

G. Mervin Ault and H. M. Burte (Wright-Patterson AFB) 1966 68 p refs Presented at Conf. on Oxide Dispersion Strengthening sponsored by the Am. Inst. of Mining, Met., and Petroleum Engr., Bolton Landing, N. Y., 27–29 Jun. 1966

(NASA-TM-X-52225) CFSTI: HC $3.00/MF $0.75 CSCL 11F

The advantages which dispersion strengthened materials offer are identified as their stability at very high temperatures, high melting point, and high thermal and electrical conductivity. Development goals are described with respect to: aluminum, titanium, and steel; superalloys and refractory metal alloys; dispersion strengthened oxidation resistant alloys; and improved ductility. Application possibilities are indicated in the turbojet engines for higher operating temperatures for the turbine stator vanes, high stressed rotating turbine buckets, and stationary nozzle vanes. The incorporation of dispersion strengthened alloys for high L/D reentry vehicle design is discussed. Other possible applications include high temperature motors and inductor generators, thermoelectric and thermionic devices for power cables, reactor fuel element cladding, and high temperature regions of supersonic and hypersonic aircraft. Processing and anisotropy are mentioned. N.E.N.

N66-31230*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CLEANING AND STABILIZATION OF DISPERSION STRENGTHENED MATERIALS

John W. Weeton and Max Quatinetz 1966 35 p refs Presented at Conf. on Oxide Dispersion Strengthening sponsored by the Am. Inst. of Mining, Met., and Petroleum Engr., Bolton Landing, N. Y., 27–29 Jun. 1966

(NASA-TM-X-52228) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A method for producing stable dispersion strengthened materials from mechanically produced blends of metal plus oxide powders is demonstrated. The method depends upon the controlled cleaning and densification of partially consolidated thin shapes. A fine ball milled blend of nickel plus alumina, with good microstructural parameters was made into coins by either wet or dry compaction. The coins were cleaned at temperatures up to 2000°F and annealed at 2300° and 2600°F in hydrogen. Although some agglomeration was noted, both methods gave products which retained ultrafine oxide particles and showed relativaly good stability even after annealing at 2600°F. The dry coins did not sinter as completely as those produced by wet compaction and the particle size increase as a result of annealing was somewhat greater. A nickel plus thoria composite with unusually good microstructural parameters was also produced from a ball milled blend. Furthermore, it is believed that the method may have aided in the reduction of chromium oxide in a chromium bearing nickel alloy and possibly eliminated sulfur in blends of nickel and thoria. Author

N66-31232# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

LOW TEMPERATURE THERMAL EXPANSION OF STRUCTURAL METALS

J. C. Horton, C. F. Smith, and R. C. Ruff 18 Apr. 1966 38 p refs

(NASA-TM-X-53436) CFSTI: HC $2.00/MF $0.50 CSCL 11F

An apparatus for the determination of low temperature linear thermal expansion of metals and plastics in the temperature range from 4° to 300°K is described. Modifications made to the apparatus to permit automatic data recording are discussed, and the data reduction process resulting from these modifications are discussed in detail. It is shown that data points, taken under equilibrium conditions, are possible at intervals of 10°K, which produces an extremely smooth and accurate data curve. Determinations were made of the linear coefficient of thermal expansion for 321, 347, and 355 stainless steels, and 2017-T4, 6061-T6, and 6061-T651 aluminum alloys in the temperature range from 10° to 300°K. The calibration and qualification run was made on 347 stainless steel. Data from all determinations are presented in both tabular and graphical form and both linear coefficient of expansion and total percentage expansion are given. The apparatus is shown to be capable of determining the linear coefficient of thermal expansion in the temperature range from 10° to 300°K with an accuracy of ±2.0 percent. Author

N66-31237# Michigan Univ., Ann Arbor. Lab. for Fluid Flow and Heat Transport Phenomena.

ULTRASONIC-INDUCED CAVITATION STUDIES IN LITHIUM AT ELEVATED TEMPERATURES Technical Report No. 5

R. Garcia and F. G. Hammitt May 1966 81 p refs (Grant NSF G-22529)

(Rept.-05031-5-T)

Ultrasonic-induced cavitation studies have been conducted in lithium at 500°F and 1500°F for seven materials including refractory alloys and stainless steels. At 500°F the refractory alloys, T-111 and T-222(A), are the most resistant to cavitation damage among the materials tested, while the Cb–1Zr(A) is the least resistant. At 1500°F the refractory alloy, T-111, is the most resistant, while the stainless steels are the least resistant. The damage suffered by a material at 1500°F was less than that measured at 500°F. This indicates that "thermodynamic effects" are significant in lithium at 1500°F. Computer correlations of the cavitation damage data at 500°F with applicable mechanical properties indicate that elongation, yield strength, true strain energy, hardness, and tensile strength are good individual indicators of cavitation resistance in these tests. Author

N66-31271# Institute of Modern Languages, Washington, D. C. Translation and Interpretation Div.
HARD ANODIZING OF BAKED ALUMINUM POWDER [TVERDOYE ANODIROVANIE SPECHENOGO ALUMINIEVOGO POROSHKA]
E. M. Zarezki and T. G. Pavlovskaya Ft. Belvoir, Va., Res. and Develop. Labs. 1966 9 p refs Transl. into ENGLISH from Mashgiz (Moscow), no. 11, 1963 p 21-22
(Contract DA-44-009-AMC-1563(T))
(ERDL-T-1823-66; AD-630688)

Experiments were conducted on baked aluminum powder (BAP) sheet samples containing 7.8% Al_2O_3 and 0.8% Fe, in order to investigate hard anodizing techniques. The anodizing was studied at H_2SO_4 concentrations of 350 and 200 g/l, within the temperature interval of +10° to −10° C; current density was increased from 0.5 to 2.5 a/dm^2 in a 10-minute interval. The average results are tabulated. Pressed BAP materials were also anodized at a sulfuric acid concentration of 200 g/l in a bath of 3.5 l in volume, at +1° to −10°C for 60 to 90 minutes. Current density was increased from 0.5 to 2.5 a/dm^2 during a 10-minute period. It was concluded that the experimental data established the possibility of hard anodizing of (1) pressed BAP material in H_2SO_4 of 200 g/l concentration at +3° to 5° C with a current density of 2.5 a/dm^2, and (2) BAP sheet material in H_2SO_4 of 200 and 350 g/l concentration at −5°C with 2.5 a/dm^2 current density. M.G.J.

N66-31274# Douglas Aircraft Co., Inc., Santa Monica, Calif.
ELECTRON FRACTOGRAPHY HANDBOOK Final Technical Report, 10 May 1963-31 Jan. 1965
A. Phillips, V. Kerlins, and B. V. Whiteson Wright-Patterson AFB, Ohio, AF Mater. Lab., 31 Jan. 1965 952 p
(Contract AF 33(657)-11127)
(AFML-TR-64-416; AD-612912) CFSTI: HC $12.10/MF $3.75

The Handbook is divided into five sections. These are: (1) Techniques—A detailed description of the most commonly used replication techniques, fracture analysis techniques, and a guide to distinguish false or 'artifact' structure. (2) Fracture modes—A guide to the various modes of fracture (or fracture morphology), their appearance in the electron microscope, and a glossary of terms commonly used in electron fractography. (3) Environmental effects—A review of the role of environmental influence on the fracture appearance. (4) Atlas of electron fractographs—A detailed compilation of over 300 specimens failed under known conditions, with the related fractographs. A general index as well as a complete cross-referencing index is also included to provide easy access to information related to specific alloy, strength level, type of test and/or environment and test temperature. (5) Bibliography—A bibliography of open literature related to the field of electron fractography. TAB

N66-31317# Yale Univ., New Haven, Conn. Kline Geology Lab.
THE YIELDING OF STEEL STUDIED BY ULTRASONICS
D. A. Koss and R. B. Gordon Oct. 1965 37 p refs
(Contract Nonr-609(35))
(TR-9; AD-633300) CFSTI: HC $2.00/MF $0.50

Changes in the ultrasonic attenuation in steel specimens have been observed during tensile tests. Samples of AISI 1021, 1045, and 1095 steel quenched and tempered to a spheroidized condition have been used. Both attenuation and microstrain measurements fail to reveal pre-yield dislocation motion in the as-tempered specimens. Upon reapplication of the load to samples in the strain-aged condition there is a large pre-yield attenuation increase but no observable microstrain up to 90% of the flow stress. These and other observed changes can be related to changes in the free dislocation density and the mean dislocation segment length. The results show that the increase in flow stress in the strain-aged-condition is caused by increased frictional stresses rather than by dislocation pinning. Strain aging is found to proceed through three distinct stages. The second of these follows the $T^{2/3}$ law and is characterized by an activation energy of 20 kcal/mole. Author (TAB)

N66-31332# Naval Research Lab., Washington, D. C.
INVESTIGATION OF THE INTERGRANULAR CORROSION OF LEAD-ANTIMONY GRID ALLOYS Interim Report
A. C. Simon 7 Apr. 1966 28 p refs
(NRL-6387; AD-633078) CFSTI: HC $2.00/MF $0.50

Microscopic examination of grid sections that had been in service for periods up to 10 years indicated that the ultimate cause of grid failure was an intergranular type of stress corrosion. While the overall corrosion resistance indicated the possibility of many additional years of service, this intergranular corrosion at isolated points had in many cases completely severed the grid member. It appeared that this corrosion was caused by a combination of stress developed in the corrosion product and microporosity in the casting. Two distinct corrosion mechanisms were observed. One type depended upon fairly acidic conditions, and the corrosion product was a hard film of lead dioxide which appeared to offer some protection to the underlying metal. The other type was generated where acid concentrations were low and was much more destructive. The corrosion product formed in this case varied from black to white and did not protect the underlying metal. Author (TAB)

N66-31348*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF ORIENTATION ON DUCTILE TO BRITTLE TRANSITION OF TUNGSTEN SINGLE CRYSTALS
Ralph G. Garlick Washington, NASA, Jul. 1966 8 p refs
(NASA-TM-X-1252) CFSTI: HC $1.00/MF $0.50 CSCL 11F

An investigation was conducted of the ductile-brittle transition behavior of zone-refined tungsten single crystals as a function of orientation. Tensile-axis orientations ⟨100⟩, ⟨110⟩, and ⟨111⟩ were studied. The transition behavior was determined to be highly orientation dependent. Crystals of the ⟨110⟩ orientation exhibited a sharp ductile-brittle transition based on reduction-in-area measurements and showed the lowest transition temperature, 205°K. Crystals of the ⟨100⟩ tensile axis exhibited a much more gradual transition with temperature from ductile to brittle behavior, with a transition temperature of about 380°K, based on a 50-percent reduction in area. The transition temperature of the ⟨111⟩ crystals was intermediate between those of the other orientations. Specimens of all orientations exhibited measurable plastic deformation at temperatures far below their respective ductile-brittle transition temperatures. Orientation also significantly affected the tensile flow characteristics of the crystals. Author

N66-31355*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FIBER-METAL COMPOSITE MATERIALS
John W. Weeton and Robert A. Signorelli Washington, NASA, Aug. 1966 43 p refs Presented at the 12th Sagamore Army Mater. Res. Conf., Roquette Lake, N.Y., 24-27 Aug. 1965 Sponsored by Army Mater. Res. Agency
(NASA-TN-D-3530) CFSTI: HC $2.00/MF $0.50 CSCL 11D

Investigations of metal matrix materials reinforced with polycrystalline ceramic and metal fibers are reviewed. The results of parametric studies with model systems and of developmental studies with practical engineering materials are described, and an indication of the future potential of fiber-reinforced composites is presented. Model system studies have demonstrated the feasibility of strengthening metal matrices with continuous and discontinuous fibers. Fiber composite materials have been fabricated that follow a law-of-mixtures behavior at room and elevated temperatures for tensile and stress-rupture applications. The importance of fiber length-to-diameter ratios and orientation and of fiber–matrix bonding and interaction also have been indicated. Results achieved in preliminary attempts to produce engineering materials have been encouraging. The potential of fiber-reinforced metal composite materials is suggested by the excellent strength of materials currently available in fiber form. Increased fiber strength can be achieved, which adds further to the advantage of composite materials. Author

N66-31356*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EFFECT OF ALLOYING ON GRAIN REFINEMENT OF ELECTRON-BEAM-MELTED TUNGSTEN

Walter R. Witzke Washington, NASA, Jul. 1966 19 p refs
(NASA-TN-D-3531) CFSTI: HC $1.00/MF $0.50 CSCL 11F

Ingot structures resulting from electron-beam melting of tungsten consist mainly of columnar grains extending the length of the ingot. In order to examine the grain refining capabilities of various elemental and refractory compound additions, small ingots of tungsten containing these additions were prepared by electron-beam melting. Measurements on transverse ingot sections from each melt indicated that all the additions decreased the average grain diameter of the columnar grains typical of electron-beam melted tungsten and that grain refining effectiveness varied with the concentration of the solutes. Losses of the additions during melting were in excess of 90 percent in many cases. The most potent grain refiner was boron. A nominal addition of 0.5 weight percent decreased the average grain diameter of the columnar grains from 0.48 to 0.08 centimeter. The effectiveness of the elemental additions decreased in the following order: boron, yttrium, carbon, hafnium, zirconium, molybdenum, columbium, rhenium, and tantalum. The losses of these elements during melting also decreased in approximately the same order. The elemental additions were generally more effective grain refiners than the refractory compounds. The elements with the smallest distribution coefficients were the most effective grain refiners.
Author

N66-31382*# Mitron Research and Development Corp., Waltham, Mass.

INVESTIGATION OF THE FIBER REINFORCEMENT OF A COBALT BASE ALLOY FOR APPLICATION AT ELEVATED TEMPERATURE

R. D. Regan, W. E. Lee, and R. A. Rosenberg May 1966 33 p
(Contract NASw-1365)
(NASA-CR-76410) CFSTI: HC $2.00/MF $0.50 CSCL 11F

A technique was developed for incorporating alumina and silicon carbide fibers in Haynes alloy 36, a cobalt base alloy. Alumina or silicon carbide fibers plunged into carbon rich Haynes alloy 36 were found in solidified cast test specimens. A definite increase in tensile strength at 1500° F was noted with increasing amounts of ceramic fibers in carbon rich Haynes alloy 36. Difficulties in consistently identifying alumina and silicon carbide whiskers in Haynes alloy 36 by standard metallographic techniques were encountered. Author

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N66-29993# Picatinny Arsenal, Dover, N. J. Plastics Technical Evaluation Center.

COMPATIBILITY OF PLASTICS WITH LIQUID PROPELLANTS. FUELS AND OXIDIZERS

Norman E. Beach Jan. 1966 126 p refs
(PLASTEC-25; AD-632287) CFSTI: HC $4.00/MF $0.75

Much has been published on the subject of the compatibility of plastics with liquid propellants, fuels and oxidizers, but invariably from the standpoint of the propellant or fuel. This report is a rearrangement of the published compatibility data from the standpoint of the plastic material. It is in the form of a tabulation, with primary arrangement by plastic (or elastomeric) material; and thereunder, by fuel. All arrangements are alphabetical, in the form given in the original reference; that is, either by generic or trade designation. The compatibility evaluation is in terms of the original document, briefly culled to show behavior of the material at a given temperature and for a given time. Elastomers are included; but oils, lubricants and greases are omitted, even though based on polymers. The information has been drawn from 43 references, which are annotated so that the information extracted from them shall have additional significance. Author (TAB)

N66-30120*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ENVIRONMENTAL AND PHYSICAL EFFECTS ON THE RESPONSE OF BALSA WOOD AS AN ENERGY DISSIPATOR

A. C. Knoell 15 Jun. 1966 37 p refs
(Contract NAS7-100)
(NASA-CR-76112; JPL-TM-32-944) CFSTI: HC $2.00/MF $0.50 CSCL 11L

This report describes the balsa-wood development program, balsa-wood specimens, static testing, and an analysis and discussion of test results. A list of conclusions based on the investigation is included. Author

N66-30207# Pennsylvania State Univ., University Park. Materials Research Lab.

FUNDAMENTAL STUDIES IN HIGH-TEMPERATURE MATERIALS PHENOMENA Annual Progress Report

Feb. 1966 67 p refs
(Contract AT(30-1)-2581)
(NYO-2581-1) CFSTI: HC $3.00/MF $0.75

Summaries are presented of research progress in the areas of the elastic anharmonic properties of perfect crystals, the properties of crystals containing high concentrations of point defects, and the initial onset of ordering in disordered systems. These topics were investigated through measurements of the dielectric, elastic, magnetic, and spectroscopic properties of ceramic materials. NSA

N66-30287# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SYNTHESIS OF NEW FIBERFORMING POLYMERS

M. M. Koton *In its* Herald of the Acad. of Sci. of the USSR 4 Aug. 1965 p 1-7 (See N66-30286 17-34) CFSTI: HC $1.00/MF $0.50

Laboratory research on the synthesis of fiberforming polymers is reported in the following areas: the kinetics and mechanism of polymerization (copolymerization) monomers, the modification of polymers, polymer structure, and the process of fiber formation. Mention is made of the polymerization of vinyl acetate, and studies are listed on the following topics: thermoplasticizing extraction of fiber from polyvinyl alcohol; hydroxyl-containing polymers; polymerization of acrylonitrile; instrumentation to evaluate synthesized fibers, and to obtain elastic-strength characteristics; thermoresistance and polymeric fiber data. Sketches are included on a microstand for studying the thermal extraction, as well as the wet formation, of fibers. R.Ll.

N66-30490*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPATIBILITY OF POLYMERIC MATERIALS WITH FLUORINE AND FLUORINE-OXYGEN MIXTURES

Louis M. Russell, Harold W. Schmidt, and Larry H. Gordon Washington, NASA, Jun. 1966 41 p refs

(NASA-TN-D-3392) CFSTI: HC $2.00/MF $0.50 CSCL 11I

Compatibility tests were performed on a number of polymeric materials with the use of various mixtures of fluorine and oxygen in both gaseous and liquid states to investigate the feasibility of using fluorine-oxygen mixtures in rocket-propulsion systems containing some nonmetallic materials. In the static tests, a number of test samples were exposed to various FLOX (fluorine-oxygen) mixtures, both gaseous and liquid, at atmospheric pressure and virtually static conditions in order to obtain information on compatibility solely as a function of fluorine concentration. In the dynamic tests, selected materials were exposed to fluorine and FLOX at various combinations of concentration and flow velocity. Reactivity profiles were generated for these materials as functions of these two parameters. Generally the fluorocarbon polymers, particularly the fully fluorinated, straight-chain polymers were the most compatible with fluorine and with FLOX. In both static and dynamic tests, a comparison between cryogenic liquid and ambient-temperature gaseous test results indicated that the liquid was the more reactive. It was concluded that some of the materials tested may be considered for use in rocket systems with fluorine or FLOX under controlled conditions of exposure. Author

N66-30497# Royal Aircraft Establishment, Farnborough (England).

ON THE THEORY OF THE GLASS TRANSITION TEMPERATURE OF HOMOPOLYMERS, COPOLYMERS AND PLASTICIZED POLYMERS [ZUR THEORIE DER GLASTEMPERATUR VON POLYMERHOMOLOGEN, COPOLYMEREN UND WEICHGEMACHTEN POLYMEREN]

Gerhard Kanig Oct. 1965 46 p refs Transl. into ENGLISH from Kolloid Z. (Darmstadt, West Germany), v. 190, no. 1, 1963 p 1-15

(RAE-LIB-TRANS-1135) CFSTI: HC $2.00/MF $0.50

A polymer melt may be considered as a solution saturated with holes. By basing thermodynamic calculations on this premise, a relationship has been derived between the glass transition temperature T_g and the degree of polymerization. Relationships have also been derived between (1) T_g and the composition of the copolymer and (ii) T_g and the plasticizer content. Author

N66-30525# American Optical Co., Southbridge, Mass. Research Div.

PREPARATION OF PLATINUM-FREE LASER GLASS Semiannual Technical Report, 1 Jul.-31 Dec. 1965

Richard F. Woodcock, George A. Granitsas, and Carl G. Silverberg [1966] 18 p refs

(Contract Nonr-4656(00); ARPA Order 306-62; Proj. Defender) (SATR-3; AD-632545) CFSTI: HC $1.00/MF $0.50

The goal of the investigation is the elimination of platinum particles in laser glass. For glasses melted in platinum crucibles, earlier work indicates that platinum-free glasses may be obtained if the glass is melted in an inert atmosphere. Various methods of homogenizing the glass in an atmosphere furnace, other than stirring, were investigated; including bubbling inert gas through the melt, convection currents and diffusion. A parallel approach to this problem, also being investigated, is the melting of high purity laser glass in an all-ceramic system. Such a system was constructed and tested. Problem areas were identified and design modifications were made where necessary. Optimization of the operational procedure of the furnace is now in progress. Author (TAB)

N66-30659# General Electric Co., Hudson Falls, N. Y. Capacitor Dept.

PRODUCTION ENGINEERING MEASURE POLYCARBONATE PLASTIC FILM Quarterly Report, 18 Feb.-18 May 1966

Lawrence S. Lazar [1966] 19 p

(Contract DA-36-039-AMC-00165(E))

(QR-4; AD-633389) CFSTI: HC $1.00/MF $0.50

A slip polycarbonate film was made in gauges of .25 and .50 mil. This was produced without loss in mechanical or electrical strength. Biaxially oriented .25 and .50 mil polycarbonate film was produced by a direct process from the extruder through the drafting rolls and the tenter frame. At the .25 mil gauge trim take off is a little troublesome and some modifications are being made. Author (TAB)

N66-30686# Rock Island Arsenal Lab., Ill. Research and Engineering Div.

ROCK ISLAND ARSENAL ELASTOMER SYNTHESIS PROGRAM, 1958-1966

Zachary T. Ossefort Apr. 1966 37 p refs

(RIA-66-1343; AD-633171) CFSTI: HC $2.00/MF $0.50

The Rock Island Arsenal elastomer synthesis program for the period 1958-1966 is reviewed. Overall objectives and general approaches are covered. Detailed objectives, approaches, results, and conclusions for twenty four projects are presented—fourteen internal and ten contracts. It is indicated that considerable progress has been made in the development of an elastomer having a combination of low temperature flexibility and resistance to hot oils. One of the biggest problems remaining is improvement in thermal stability of elastomers. Several research problems in this area which might have future potential are listed. Author (TAB)

N66-30701# Naval Research Lab., Washington, D. C.

THERMAL DEGRADATION PROCESSES IN POLYSILOXANES AND THERMAL STABILIZATION BY A CERIUM INHIBITOR

C. M. Murphy, H. Ravner, and R. E. Kagarise 6 Apr. 1966 26 p refs
(NRL-6383; AD-633068) CFSTI: HC $1.00/MF $0.50

Studies were made of the effects of cerium on the degradation of polyorganosiloxanes (silicones) at 400°C in the absence of oxygen. Thermally stressed polydimethylsiloxanes undergo —Si—O bond rupture, initiating anion-propagated degradation to cyclics and linear residues. One-hundred-percent polymethylphenylsiloxanes do not cyclize, but undergo rearrangements leading to crosslinking. In polydimethylsiloxanes, cerium is considered to form active sites which react reversibly with anion fragments, thus limiting further degradation. Cerium has little effect on polymethylphenylsiloxanes, but stabilizes copolymers in direct ratio to the dimethyl content. The excellent response of polydimethyl and lightly phenylated siloxanes to cerium, together with their desirable physical properties, make their use attractive as high-temperature lubricants and hydraulic fluids in selected applications.
Author (TAB)

N66-30848*# Stanford Research Inst., Menlo Park, Calif.
STUDY OF GROWTH PARAMETERS FOR REFRACTORY CARBIDE SINGLE CRYSTALS Quarterly Status Report No. 9, 1 Mar.–1 Jun. 1966
R. W. Bartlett 27 Jun. 1966 17 p
(Contract NASr-49(19))
(NASA-CR-76365) CFSTI: HC $1.00/MF $0.50 CSCL 20B

During this period the new arc-Verneuil crystal growing furnace was installed and tantalum carbide crystal growth experiments were resumed. Mechanical operation of the crystal grower is satisfactory. It produces uniform operating conditions and symmetrically shaped boules. However, a major impediment to tantalum carbide crystal growth is decarburization of the boule, which occurs in all atmospheres in which a low voltage ac arc is stable. Under operating conditions which provide improved stoichiometry ratios, arc stability is still quite poor. Hafnium carbide and tantalum–hafnium carbide powders in a size range suitable for crystal growth were ordered. Metal solution growth experiments have not yielded tantalum carbide crystals larger than 0.2 mm, and therefore, work in this area was discontinued.
Author

N66-30903# California Univ., Berkeley. Lawrence Radiation Lab.
MECHANICAL PROPERTIES OF CONTINUOUS-MATRIX, DISPERSED-PHASE CERAMIC SYSTEMS
D. P. H. Hasselman (Ph.D. Thesis) 27 Dec. 1965 85 p refs
(Contract W-7405-ENG-48)
(UCRL-16552) CFSTI: HC $3.00/MF $0.75

The mechanical properties of brittle continuous-matrix, dispersed-phase multicomponent ceramic systems were investigated. The effect of dispersed phases of crushed sapphire, spherical tungsten particles, and spherical pores on the elastic behavior of a sodium borosilicate glass was determined. Good agreement with theory was obtained. The effect of cylindrical porosity on Young's modulus of a brittle matrix was calculated, and good agreement was obtained with the experimental effect of porosity on elastic properties of polycrystalline ceramics. A fracture theory was developed for a dispersion-strengthened glass matrix based on the criterion that the dispersions within the glass matrix limit the size of the Griffith flaws responsible for failure. Experimental evidence is presented which substantiates the proposed theory. The effect of stress concentrations on strength was investigated by loading suitable specimens to failure under conditions of uniaxial and biaxial tensile stress. Specimens consisted of the sodium borosilicate glass containing spherical particles of alumina and of the same glass containing spherical pores. Results could be interpreted in terms of the maximum value of the stress concentrations and in terms of the volume of material over which the stress concentration acts. Results also indicate that for multicomponent systems any differences in strength under different stress states can be attributed at least in part to microstructure. A hypothesis is presented that suggests that the effect of stress concentrations on strength is governed by the relative size of the Griffith flaw and the size or volume of material over which the stress concentrations act. On this basis a theory is presented for the effect of porosity on strength in terms of flaw size to pore size. An approximate derivation is presented which suggests that once the effect of stress concentration on strength has occurred, further relative changes in uniaxial tensile stress are governed by the relative changes in Young's modulus with porosity. A porosity-clustering factor is introduced to take into account nonuniform distribution of the porosity throughout the ceramic body.
Author (NSA)

N66-31038# Gt. Brit. National Inst. for Research in Nuclear Science, Chilton. Rutherford High Energy Lab.
SOME TESTS ON CIRCULAR DIAPHRAGMS OF POLYETHYLENE TEREPHTHALATE FILM
D. R. Moore and A. R. Mortimer Aug. 1965 40 p refs
(RHEL/R-107) HMSO: 7s

Bursting pressures and deflections of diaphragms made from biaxially oriented polyethylene terephthalate film were investigated in the unirradiated and irradiated states. Creep and permeability were determined and a suitable clamping method was developed. The life of the film under irradiation was estimated.
Author (NSA)

N66-31137# Olin Mathieson Chemical Corp., New Haven, Conn. Chemicals Div.
SiB POLYMER DEVELOPMENT Final Report, 1 Feb. 1965–31 Jan. 1966
H. A. Schroeder, O. G. Schaffling, T. B. Larchar, F. F. Frulla, and T. L. Heying 28 Feb. 1966 61 p refs
(Contract NObs-92143)
(AD-632035) CFSTI: HC $3.00/MF $0.75

Selected members of the SiB polymer family were developed for high temperature applicable elastomers. Three measurements, namely tensile strength, elongation, and hardness, were performed from −80° to 800°F. Other characteristics were obtained on specific specimens. With the proper selection and concentration of reinforcing fillers and antioxidants (ferric or tungsten oxide are indispensable), vulcanizates of SiB-2 and SiB-4 rubber exhibit outstanding heat-aging resistance. They show a tensile strength of 400–450 psi and an elongation of 100–150% at ambient temperature, and withstand temperatures of 800° to 900°F in air, demonstrating a useful life of 24 hours and 2 hours, respectively. They were still flexible at −40° to −80°F, indicating a wide range of elasticity. Limited experimentation indicated their immunity to humidity and water immersion. The solvent resistance was improved by introduction of a minute number of chloromethyl groups. Dielectric constants approached those of the silicones. Since the uncured SiB elastomers can be molded or extruded, special applications such as wire coating, gasket and O-ring fabrication can be envisioned.
TAB

N66-31165*# Stanford Research Inst., Menlo Park, Calif.
ORGANOMETALLIC MATERIALS FOR SPACECRAFT USE Final Report

Jorge Heller 13 Dec. 1965 38 p refs
(Contract NAS5-9617)
(NASA-CR-75451) CFSTI: HC $2.00/MF $0.50 CSCL 11I

Thermal conductivities of a number of organometallic compounds were measured. Results of these measurements showed that simple organometallic compounds have thermal conductivities typical of organic compounds, i.e., in the neighborhood of 10^{-4} cal-cm/sec-cm^2-°C. Preliminary data were obtained on the effect of filling a typical epoxy adhesive with aluminum metal. It was found that an excessive amount of powdered metal would have to be used in order to achieve a significant increase in thermal conductivity. Various approaches for increasing thermal conductivity without decreasing electrical resistivity were evaluated. From this evaluation the, concept evolved that a polymeric structure containing heavy atoms in the backbone and having structural continuity might satisfy the objectives of this study. An outline of a recommended experimental program is presented. Author

N66-31346*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTICAL STUDY OF DIFFUSION-CONTROLLED CHAR OXIDATION AND ITS EFFECT STEADY-STATE ABLATION OF PLASTIC MATERIALS
Gerald D. Walberg Washington, NASA, Jul. 1966 45 p refs
(NASA-TR-R-242) CFSTI: HC $2.00/MF $0.50 CSCL 20M

An analysis of diffusion-controlled char oxidation has been carried out and differs from previous analyses in one important respect: previous investigators have assumed that only the carbon present in the char would react, but the present analysis has shown that the carbon present in both the char and the pyrolysis gases (i.e., all the carbon originally present in the virgin plastic) reacts and that the reaction rate is determined by the rate at which oxygen can be supplied by diffusion through the boundary layer plus pyrolysis of the plastic. Because of this fact, the char oxidation rate, the steady-state ablation rate, the boundary-layer composition at the char surface, and the heat released by chemical reactions were found to be dependent on the composition of the virgin plastic and the pyrolysis gases. For a given flow environment, the char oxidation rate and the steady-state pyrolysis rate were found to increase as the hydrogen, nitrogen, and oxygen contents of the virgin plastic increased and to decrease as the carbon content of the virgin plastic increased. It was found that that heat released by both gas phase and heterogeneous reactions can be accounted for by an "effective enthalpy potential" which is a function of the stream oxygen mass fraction and the compositions of the virgin plastic and the pyrolysis gases. Author

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N66-30019# Illinois Univ., Urbana. Coordinated Science Lab.
WEIGHT DISTRIBUTION FORMULA FOR SOME CLASS OF CYCLIC CODES
Tadao Kasami Apr. 1966 28 p refs
(Contracts DA-28-043-AMC-00073(E); AF 19(628)-4379; Grant NSF GK-690)
(R-285; AD-632574) CFSTI: HC $2.00/MF $0.50

Let $h_1(X)$ and $h_2(X)$ be different irreducible polynomials such that $h_1(\alpha^{-2^h-1})=0$ for some $h(0<h<m)$ and $h_2(\alpha^{-1})=0$, α being a primitive element of $GF(2^m)$. This paper presents the weight distribution formula of the code of length 2^m-1 generated by $(X^{2^m-1}-1)/(h_1(X)h_2(X))$ for any m and h. Some applications to the cross-correlation problem between two different maximum length sequences are presented. Author

N66-30037# System Development Corp., Santa Monica, Calif.
MATRIX MANIPULATION BY COMPUTER: THE GENERAL SOLUTION OF LINEAR ALGEBRAIC EQUATIONS
John Staudhammer 20 Apr. 1966 32 p refs
(TM-2891/001/00; AD-632479) CFSTI: HC $2.00/MF $0.50

A computer program is described that gives the solution of a general set of M algebraic equations in N unknowns. The program reduces the given augmented matrix to an upper triangular array of K equations; a check for consistency is then made of the remaining M-K equations. Consistent sets are solved for the unique solution vector (if it exists) or for dependencies of the unknowns. The order of retention (or elimination) of the variables may be specified. At the first pass the Gauss elimination process is used to arrive at the dependencies in the unknowns; optionally the problem can be recycled to be recalculated (using the now known dependencies) by means of the method of pivotal condensation. The solution thus obtained may be further refined by iteration; two options are provided: simple iteration and Gauss–Seidel iteration. The program is arranged to provide copious intermediate printing, which can be selected either from control cards or from the computer console. The program represents an intermediate result in a sequence of programs developed to teach matrix manipulations by computer. The given version is not optimal in any sense, but was checked with a number of examples and found to perform satisfactorily. A Fortran II version for the Philco S-2000 computer is given. Author (TAB)

N66-30040# California Univ., Los Angeles. Western Management Science Inst.
A MARKOVIAN ALGORITHM FOR STRICTLY CONCAVE PROGRAMMING WITH LINEAR CONSTRAINTS
Arthur M. Geoffrion Mar. 1966 15 p refs
(Contract Nonr-233(75))
(AD-632525) CFSTI: HC $1.00/MF $0.50

Theil and van de Panne have shown how to replace the problem of maximizing a (strictly concave) quadratic function subject to linear inequality constraints by a finite sequence of sub-problems involving only linear equality constraints. In another paper, the author generalized this approach to (I) cover the case of a differentiable and strictly concave objective function, and (II) permit almost complete flexibility in the choice of the initial sub-problem. The last feature seems essential for the approach to be of computational interest, for computational experience suggests that the number of sub-problems that must be solved and the amount of computer storage required to keep track of them have a tendency to grow approximately exponentially with the 'poorness' of the choice of the initial sub-problem. In this paper a modification of the above approach is proposed which generates the sub-problems in Markovian fashion. This all but eliminates the storage problem. Although the resulting sequence of sub-problems is no longer necessarily finite, by means of the theory of Markov chains it is shown that eventual convergence to the optimum is assured with probability one and argued that the expected number of sub-problems that must be solved

increases only approximately linearly with the 'poorness' of the initial sub-problem. Computational evidence is given which supports this estimate and suggests the probable efficiency of the Markovian algorithm even for quite 'bad' choices of the initial sub-problem. Author (TAB)

N66-30044# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
TABLES AND CURVES OF THE ERLANG DISTRIBUTION FUNCTION FOR K=1 THROUGH K=25
Sterling I. Solomon and Ernest L. Staples Jul. 1964 172 p refs
(Contract NOw-62-0604-c)
(TR-579; PAM-79; AD-631829) CFSTI: HC $5.00/MF $1.00

Experience has shown that many queueing situations, which are difficult or impossible to treat analytically, may be handled quite readily by simulation. An early consideration must be a choice of 'arrival' and 'service' distributions and the methods one uses for their simulation. This paper discusses the 'Erlang family' of arrival and service time distributions which is highly useful in queueing applications. Included are tables and curves of the cumulative Erlang distribution function and directions for their use in the simulation of waiting line situations. TAB

N66-30045# Purdue Univ., Lafayette, Ind. Dept. of Statistics.
ON SELECTING A SUBSET CONTAINING THE BEST OF SEVERAL DISCRETE DISTRIBUTIONS
Klaus Nagel Mar. 1966 16 p refs
(Contract AF 33(657)-11737)
(AD-630663) CFSTI: HC $1.00/MF $0.50

Problems connected with selecting a subset containing the best of several binomial populations are examined, and equations are formulated for obtaining a lower bound for the probability of correct selection for any finite discrete distribution with the property TP_2. Formulas are also given for minimizing the class of discrete distributions, along with numerical results for the binomial case. M.G.J.

N66-30234# California Univ., Berkeley. Lawrence Radiation Lab.
MULTIDIMENSIONAL CORRELATION LATTICES AS AN AID TO THREE-DIMENSIONAL PATTERN RECONSTRUCTION
Samuel J. Penny and James H. Burkhard 26 Jan. 1966 23 p refs Presented at the Spring Joint Computer Conf., Boston, 26-28 Apr. 1966
(Contract W-7405-ENG-48)
(UCRL-16478; CONF-660407-2) CFSTI: HC $1.00/MF $0.50

A technique was developed to perform an efficient and exhaustive search for solutions of certain types of combinatorial problems. The basic tool of the technique is the "correlation lattice" for which the properties and algorithms for manipulation are presented. The technique is described as applied to the spatial reconstruction of a nuclear-particle interaction from three stereo photographs. In this example the particle-track images in each of the three stereo views must first be unambiguously correlated and the spurious images discarded. Then the spatial trajectories of the particles may be computed. Though illustrated for the nuclear-particle application, the technique is also applied in other fields. Author (NSA)

N66-30248# Northwestern Technological Inst., Evanston, Ill.
CHANCE-CONSTRAINED GENERALIZED NETWORKS Systems Research Memorandum No. 149
Abraham Charnes, Michael J. L. Kirby, and William M. Raike Mar. 1966 15 p refs
(Contracts Nonr-1228(10); DA-31-124-ARO(D)-322; Grants PHS-WP-00019-06; PHS-EF-00355-04)
(AD-631929) CFSTI: HC $1.00/MF $0.50

An extension to the theory of linear programming over generalized networks is presented which replaces the generalized Kirchoff node conditions by chance constraints. The extension is motivated by a class of problems in sanitary and chemical engineering in which the non-zero entries in the generalized incidence matrix may be random variables. Duality relationships are established for appropriate pairs of such chance-constrained programming problems by showing that their deterministic equivalents consist of a deterministic generalized network problem and its dual. It is also shown how these duality relationships may be exploited in order to obtain actual solutions to chance-constrained generalized network problems. Author (TAB)

N66-30259*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
LINEAR PREDICTION ON A FINITE PAST OF A MULTIVARIATE STATIONARY PROCESS
Ray G. Langebartel Washington, NASA, Jul. 1966 34 p refs
(NASA-TR-R-244) CFSTI: HC $2.00/MF $0.50 CSCL 12A

An overview is given of multivariate, wide-sense, stationary, stochastic process, linear prediction theory with emphasis on the mean square error or prediction based on a finite past. Examples of several different types of processes are examined with specific formulas for the prediction errors obtained in some cases. A discussion is given concerning the effect on the prediction error of basing the prediction on a subprocess of the given process instead of on the entire original process. Author

N66-30285# Pennsylvania Univ., Philadelphia.
DIFFERENTIABLE ACTIONS ON HOMOTOPY SEVEN SPHERES Interim Technical Report No. 3
D. Montgomery and Chung-Tao Yang [1963] 34 p refs
(Grant DA-ARO(D)-31-124-G177)
(AROD-2056-14; AD-619310) CFSTI: HC $2.00/MF $0.50

This report presents studies of differentiable actions of the circle group SO(2) on homotopy 7-spheres. The class of free such actions is shown to form an infinite abelian group which is closely related to the group of differentiable knotted 3-spheres in the 6-sphere. Studies are also presented on actions, each having a 3-sphere as the fixed point set and acting freely otherwise. Author (TAB)

N66-30318# Washington Univ., Seattle.
OBTAINING A BEST-FITTING FACTOR STRUCTURE
Bruce McArthur Bloxom Apr. 1966 14 p refs
(Contract Nonr-477(33); NIH G-MH-00743-08)
(AD-480997)

In order to compare factor structures from different groups of subjects, it is helpful to obtain a best-fitting factor structure, i.e., one which best approximates the factor structures being compared. This report compares the results of three methods for obtaining a best-fitting factor structure. The best result is from a principal axis factoring of the average of the approximated correlation matrices. Using

the average manifest correlation matrix provides an equally good 'best fit' only for the factors corresponding to the larger eigenvalues. Author (TAB)

N66-30578# Bettis Atomic Power Lab., West Mifflin, Pa.
AN EXTENSION OF HOT-1 TO TREAT NEUMANN BOUNDARY CONDITIONS—WITH APPLICATIONS TO CERTAIN VIBRATION PROBLEMS
R. B. Kellogg, W. D. Peterson, and J. Spanier Jun. 1965 13 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-535) CFSTI: HC $1.00/MF $0.50

An extension of the HOT-1 program to treat problems in (x,y) geometry in which the normal derivative of the solution function is specified at every point on the boundary is described. The program is also applicable to more general problems with Neumann boundary conditions. The treatment of the effects of water on the natural frequency of a beam, theoretical analysis needed for the extension of HOT-1 to the Neumann problem, and the input changes required and the output produced for such problems are described. NSA

N66-30624# Illinois Univ., Urbana.
NUMERICAL ANALYSIS OF PLANE STRUCTURE-MEDIUM INTERACTION IN ELASTIC-PERFECTLY PLASTIC MEDIA
George C. Chang and A. H.-S. Ang Jun. 1966 189 p refs *Its* Civil Eng. Studies Structural Res. Ser. no. 307
(Grants NSF GP-984; NSF GK-589)

A numerical procedure was developed to study dynamic structure-soil interaction problems in either elastic or elastic–plastic media in relation to the design of underground protective structures which can resist blast loadings. A typical structure-soil interaction phenomenon is demonstrated; and yield capacity of the medium, relative stiffnesses of the tunnel liner and medium, and other parameters are investigated. A practical computational procedure is described for the study of the interaction of a plane stress wave with a lined or unlined tunnel in an elastic or elastic-perfectly plastic medium. Stresses for the two media are quite different; the elastic solutions generally overestimate maximum stresses. Reinforcing the tunnel with a lining results in a change of stress in the cavity vicinity, and forces between the medium and the tunnel liner increase with the stiffness of the liner. Free-field motions and stresses are significantly affected by the presence of an underground tunnel. Mathematical models are discussed for both Cartesian and bicylindrical coordinate systems; and the numerical calculation of wave propagation problems is presented. M.W.R.

N66-30639# California Univ., Los Angeles. Dept. of Mathematics.
CAPACITY FUNCTIONS IN RIEMANNIAN SPACES Technical Report No. 42
Wellington Ham Ow (Ph.D. Thesis) Jun. 1966 71 p refs
(Grant DA-ARO(D)-31-124-G742)
(AROD-1517-91; AD-633082) CFSTI: HC $3.00/MF $0.75

The existence of the capacity function in an arbitrary noncompact Riemannian space is proved and the capacity is then defined for boundary components as well as the ideal boundary. Moreover, the capacity function of the ideal boundary is shown to possess certain extremal properties. An equivalence relation between the capacity of the ideal boundary, the Green's function, and the harmonic measure of the ideal boundary is given. Certain criteria are given which then enable one to determine under what conditions the capacity of a boundary component is zero. The extremal length of a family of curves is discussed and certain basic theorems involving it are stated. Author (TAB)

N66-30663# Naval Ordnance Lab., White Oak, Md.
EFFECT OF DEPENDENCE CRITERION ON HIT PROBABILITIES ASSOCIATED WITH MULTIPLE WARHEAD OR SALVO FIRINGS
Robert C. Kline and Ralph E. Ferguson 25 Mar. 1966 29 p
(NOLTR-66-37; M-63; AD-632846) CFSTI: HC $2.00/MF $0.50

This report consists of a description and comparative study of three math models used in estimating salvo hit probabilities. A 'hit' is said to occur if at least one of the points defining the landing positions of the weapons coincides with a point defining the target area. The essential difference in these models is the assumed statistical dependence between the landing positions of the various members of a salvo. In each model the landing position of each weapon is assumed to have a circular normal distribution function. The first model assumes the landing position of the individual weapons of the salvo are independently and identically distributed. The second model assumes the salvo of weapons is dispersed in a well defined rectangular array. The third model assumes that the weapons which form the salvo are randomly distributed within a circular region where the center of the circle is determined by a random selection from a circular normal distribution. The adopted dependence criteria can, in general, have a significant effect on outcomes of salvo firings, and whether or not one model is 'better' than another depends on the range and/or distribution of situations under consideration. Author (TAB)

N66-30662# Aberdeen Proving Ground, Md.
RELIABILITY ESTIMATION FOR MULTI-COMPONENT SYSTEMS
James R. Kniss Jan. 1966 21 p refs Presented to the 9th Conf. on Design of Expt. at Redstone Arsenal, Ala.
(BRL-MR-1727; AD-633163) CFSTI: HC $1.00/MF $0.50

A system for obtaining point estimates and confidence interval estimates for very complex multi-component systems has been developed. This method was developed specifically to be used to estimate reliabilities of nuclear warheads where the redundancy of circuits and components complicate normal procedures of reliability estimation. However, the system is highly adaptable to any similar situation where access to high speed electronic computers is available. Author (TAB)

N66-30664# Stanford Univ., Calif. Dept. of Statistics.
A NEW APPROACH TO TIME SERIES WITH MIXED SPECTRA Technical Report No. 17
George R. Hext 16 May 1966 241 p refs
(Grant DA-ARO(D)-31-G726)
(AROD-2025-18; AD-633393) CFSTI: HC $6.00/MF $1.25

The time series considered have jumps in their spectral distribution function; that is, the series is the sum of a 'signal' component, comprising a finite linear sum of pure sine-waves, and a 'noise' component, having continuous spectral density function. Given a set of observations from such a time series the primary problem is to estimate the 'signal' frequencies, the power in each component of the signal, and the 'noise' spectral density at these frequencies. The essence of the method used is as follows. For a given set of observations

from such a series, and for each frequency that might yield a signal component, several estimates of the spectral density are made, using spectral windows of different bandwidths. To a first approximation, the noise component of the estimate is the same for every window, while the part of the estimate due to the signal is inversely proportional to the bandwidth of the window. Thus using a regression technique, one can separate the signal power from the noise spectral density at the given frequency and estimate these two quantities. Author (TAB)

N66-30685# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

MACHINE COMPUTATION OF TRIGONOMETRIC EXPANSIONS

David Bushnell and Wayne A. Madsen May 1965 27 p

(Contract AF 49(638)-1276)

(AFOSR-66-0128; SUDAER-235; AD-632898) CFSTI: HC $2.00/MF $0.50

A new technique for the computer solution of problems in solid mechanics is introduced, and an example of the large deflections of a spherical cap is used to illustrate the method. Coding systems can be established through which powers of trigonometric series are expanded by the computer. The method is particularly suited to problems involving the minimization of potential energy with respect to undetermined coefficients. If long series expansions of the dependent variables are needed for adequate convergence, hand computation of the potential energy expression in terms of the undetermined coefficients is too tedious. Author (TAB)

N66-30689# Stanford Univ., Calif. Dept. of Statistics.

FRACTIONAL BROWNIAN MOTION, SELF-SIMILAR PROCESSES, AND APPLICATIONS Technical Report No. 15

Benoit B. Mandelbrot and John W. Van Ness 1 Mar. 1966 44 p refs

(Grant DA-ARO(D)-31-124-G726)

(AROD-2025-15; AD-632745) CFSTI: HC $2.00/MF $0.50

A family of Gaussian processes, called fractional Brownian motion, which arise naturally from an examination of the conditions of validity of the centra-limit theorem, is studied. Fractional Brownian motion possesses an important property of "self-similarity." This property leads to a more general class of processes, not necessarily Gaussian, called self-similar processes. This paper is addressed to mathematicians, scientists, and engineers; the material is arranged in order of increasing mathematical sophistication. Author (TAB)

N66-30690# Sylvania Electric Products, Inc., Mountain View, Calif. Electronic Defense Labs.

ESTIMATION OF THE LAPLACE-TRANSFER FUNCTION FROM SAMPLED DATA

Fred W. Smith and W. Bruce Hilton 30 Nov. 1965 182 p refs

(Contract DA-28-043-AMC-00379(E))

(EDL-M874; AD-633066) CFSTI: HC $5.00/MF $1.00

This report describes the results of a study and experimental evaluation which were undertaken to compare methods for estimating the Laplace transfer function of a time-invariant linear system when given only the normal input and output of the system which has been obscured by noise and is in sampled data form. In the theoretical study the transfer function estimation methods described in current literature were reviewed. The most promising of these methods are given in the report. In addition to the current techniques, the study has developed an improved method for estimating the Laplace transform in certain situations. The experimental evaluation was made by using the most promising current techniques and the new techniques in two typical examples. The results of this evaluation indicate that certain of the current techniques are decidedly superior to others and that the new method offers a definite improvement over previous methods for estimating the Laplace-transfer function from sampled data. Author (TAB)

N66-30698# California Univ., Berkeley. Operations Research Center.

AN ORTHOGONALIZATION METHOD OF COMPUTING THE GENERALIZED INVERSE OF A MATRIX

C. R. Glassey Apr. 1966 18 p refs

(Contracts Nonr-222(83); DA-31-124-ARO(D)-331; Grant NSF GP-4593)

(ORC-66-10; AROD-5307-11; AD-633061) CFSTI: HC $1.00/MF $0.50

A method of computing the generalized inverse of a matrix is derived from the behavior of a linear transformation and its generalized inverse relative to the range and null space of the operator. The method utilizes the Gram–Schmidt procedure to obtain an orthogonal basis for the column space of the matrix, and then the biorthogonalization technique of Hestenes to obtain the inverse of a matrix that has the same rank as the original. A matrix multiplication then yields the required generalized inverse. Author (TAB)

N66-30760*# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.

LIE SERIES SOLUTIONS OF PARTIAL DIFFERENTIAL EQUATIONS Final Report, 1 Jul. 1965–31 Jul. 1966

Ferdinand Cap 30 Jun. 1966 11 p

(Grant NgR-52-046-001)

(NASA-CR-96314) CFSTI: HC $1.00/MF $0.50 CSCL 19A

Progress is reviewed on the scientific program concerned with the application of Lie series to the solution of linear ordinary differential equations of second order. Work consisted of investigating linear homogeneous and inhomogeneous equations and applying general solutions to special problems in physics and the differential equations, which result from the separation of the Helmholtz equation. Scientific reports during the period are listed and briefly explained. S.P.

N66-30822# Sandia Corp., Albuquerque, N. Mex. Scientific Translation Service.

THE TRIPLE IMPULSE ASYMPTOTIC PATHS [DER DREIERSTOSS. ASYMPTOTISCHE BAHNEN]

Carl Ludwig Siegel 28 Jul. 1965 10 p Transl. into ENGLISH from Ann. Math. (Germany), v. 42, sect. 11, 1941 p 156-162

(SC-T-65-749)

The solutions for a system of differential equations of the form $d\delta_K/dS = \sum_{i=1}^{n} a_{Ki}\,\delta_i + \Psi_K$ (K = 1, . . . , n), were obtained. Two assumptions are made: a_{Ki} is a real constant, and Ψ_K is a power series of the variables $\delta_1, \ldots, \delta_n$ with real coefficients which converge in a certain neighborhood of the zero point and which contain neither constant nor linear members. NSA

N66-31022# Joint Inst. for Nuclear Reactions, Dubna (USSR). Lab. of Theoretical Physics.
ON THE THEORY OF THE ASYMPTOTIC REPRESENTATION OF SPHEROIDAL FUNCTIONS [K TEORII ASIMPTOTICHESKOGO PREDSTAVLENIYA SFERPODAL'NYKH FUNKTSII]
L. I. Ponomarev 1966 7 p refs In RUSSIAN
(JINR-P-2564)

Using the WKB-method a transcendental equation is obtained which allows one to approximately calculate the eigenvalues of the boundary value problem for the spheroidal functions. Author (NSA)

N66-31089# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
DIPOD SAMPLING: A METHOD FOR STUDYING THE DISTRIBUTION OF FINITE PARTICLES
Robert Hooke 17 Jun. 1965 17 p ref
(Contract NObs-78844)
(WERL-8844-10) CFSTI: HC $1.00/MF $0.50

The distribution of finite particles was investigated. The problem is to test whether a collection of particles shows a tendency toward attraction or repulsion other than that caused by their physical size. Since there seem to be various non-equivalent ways of describing a "random" distribution of such particles, and since these ways lead to intricate problems of geometric probability, a different approach is used. This approach is through the sampling procedure, and specifically a procedure is used involving two sample points a fixed distance d apart. This pair is called a dipod, and by studying the results of dipod sampling for various values of d, one can obtain a test for the presence of attraction or repulsion of particles. Author (NSA)

N66-31109# Cambridge Language Research Unit (England).
A SEQUENTIAL LOGIC FOR INFORMATION STRUCTURING Final Report, Period Ending 31 Mar. 1965
E. W. Bastin, A. F. Parker-Rhodes, and D. S. Linney 1 May 1965 55 p refs
(Grant AF-EOAR-63-64)
(AFOSR-65-1883; AD-625488) CFSTI: HC $3.00/MF $0.50

Results are reported of three studies based in part on the intuitionist logic of L. E. J. Brouwer. In 'Mathematics of a Hierachy of Brouwerian Operations,' by E. W. Bastin, an algebraic system is used to represent the structure provided by the total set of decisions that can be made about the progress of any Brouwer time sequence. Concepts of level, element of level, and hierachy of levels are introduced. It is shown that an element of a given level determines a decision about the progress of a sequence by specifying two contiguous terms at the adjacent simpler level of the hierarchy. Each element of a given level is then considered as an operator on the elements at the adjacent simpler level, and as being in the relation of operand to the elements at the adjacent more complex level. In 'An Operational Hierachy,' by A. F. Parker-Rhodes, an algebraic structure is described for automata which perform a sequence of operations, each of which restricts the range of operations which can follow it, in such a way that the sequence eventually terminates. The model is based on representing the operations of the sequence by linear transformations on vector spaces over the field of elements J_2. Author (TAB)

N66-31124# Florida State Univ., Tallahassee. Dept. of Statistics.
A NOTE ON THE RATIO OF STEADY STATE PROBABILITIES FOR ERGODIC MARKOV CHAINS
Vincent Hodgson Sep. 1965 6 p ref
(Contract Nonr-988(08))
(M91; ONR-TR-18; AD-623831) CFSTI: HC $1.00/MF $0.50

A new derivation is given of the result that the ratio of steady state probabilities P_j/P_i is equal to the expected number of times a Markov chain starting at state i is in state j before it returns to state i. Author (TAB)

N66-31182# Florida State Univ., Tallahassee. Dept. of Statistics.
SEQUENTIAL RANK TESTS. II: A MODIFIED TWO-SAMPLE PROCEDURE
Ralph A. Bradley, Sarla D. Merchant, and Frank Wilcoxon Jun. 1965 21 p refs
(Contract Nonr-988(08))
(FSU-M-80; ONR-TR-16; AD-623829) CFSTI: HC $1.00/MF $0.50

This paper describes modifications of the sequential, two-sample, within-group, rank tests developed earlier. A modified, configural rank test is discussed in some detail and is a procedure based on reranking of observations as new groups of observations are obtained sequentially. A numerical application is given. Monte Carlo results are presented on the modified, configural rank test and compared with earlier studies. Proofs of termination of the test are reported and outstanding unsolved problems noted. Author (TAB)

N66-31199# European Space Vehicle Launcher Development Organization, Paris (France). Basic Techniques Div.
INTRODUCTION TO THE ABSOLUTE DIFFERENTIAL CALCULUS [INTRODUCTION AU CALCUL DIFFERENTIEL ABSOLU]
E. Cambi Feb. 1966 51 p refs In FRENCH; ENGLISH summary
(ELDO-TM-F-26) CFSTI: HC $3.00/MF $0.50

This report is not a textbook on tensor analysis. It is an attempt to make an introduction to the subject intended to be of use to an engineer who knows the basic elements of differential calculus. It therefore introduces the reader to various reference books which use different mathematical symbol representations in order to facilitate the understanding of tensor analysis methods as described in any system. The author also reviews the aims, essential methods and the first applications of such methods (principles of absolute differential calculus, intrinsic geometry, notions of differential geometry of surfaces, etc.). I.M.

N66-31207*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COMPUTER GENERATION OF QUADRATURE COEFFICIENTS UTILIZING THE SYMBOLIC MANIPULATION LANGUAGE FORMAC
Paul Swigert Washington, NASA, Aug. 1966 21 p refs
(NASA-TN-D-3472) CFSTI: HC $1.00/MF $0.50 CSCL 12A

A method for constructing quadrature coefficients through the use of a FORMAC computer program is presented. The computer program has the ability to construct exact rational fraction coefficients for quadrature formulas of a wide class of weight functions. Quadrature coefficients, constructed by the FORMAC program, are presented for certain weight functions and collocation points. Author

N66-31257# Texas A&M Univ., College Station.
MULTIPLE QUADRATURE BY MONTE CARLO TECHNIQUES
John Dietrich Voss (M.S. Thesis) May 1966 79 p refs
(Contract AF 33(608)-1284)
(AD-633204) CFSTI: HC $3.00/MF $0.75

The Monte Carlo method of numerical quadrature was used to integrate functions which are difficult and tedious to integrate by other methods. The central cumulative Chi-square distribution was obtained by integration of an exponential function of N variables over a hypersphere of dimension N, where N is the number of degrees of freedom (around 30). The noncentral cumulative Chi-square distribution was also obtained. The results were checked against a table of known values, and computer programs were written to evaluate the integrals. It was concluded that the technique for evaluating the central cumulative Chi-square distribution integral is reasonably efficient. The average relative error when using 1000 points was 0.0824, and decreased to 0.0071 when 25,000 points were used. The noncentral cumulative Chi-square distribution was more difficult to evaluate and possible explanations are discussed. N.E.N.

N66-31263# Wisconsin Univ., Madison. Dept. of Statistics.
DESIGN OF EXPERIMENTS FOR PARAMETER ESTIMATION IN MULTIRESPONSE SITUATIONS
Norman R. Draper and William G. Hunter Jan. 1966 20 p refs
(Contract Nonr-1202; Grant NSF GP-2755)
(TR-63; AD-632519) CFSTI: HC $1.00/MF $0.50

A criterion is developed for the choice of N experimental runs in multiresponse situations, after N runs are already available. The criterion is applied to three examples involving two particular non-linear multiple response models and the results are discussed. Author (TAB)

N66-31296# Lincoln Lab., Mass. Inst. of Tech., Lexington.
AN EFFICIENT TECHNIQUE FOR THE CALCULATION OF VELOCITY-ACCELERATION PERIODOGRAMS
Edward M. Hofstetter 18 May 1966 12 p ref *Its* Tech. Note 1966-31
(Contract AF 19(628)-5167; ARPA Order 498)
(ESD-TR-66-208; AD-633215) CFSTI: HC $1.00/MF $0.50

The Cooley–Tukey method for greatly reducing the number of computations required to evaluate a velocity periodogram has been extended to the evaluation of velocity-acceleration periodograms. For N data points, this method requires approximately a factor of 2/3 N fewer computations than would be required by straightforward evaluation of the periodogram. Author (TAB)

N66-31319# Parke Mathematical Labs., Inc., Carlisle, Mass.
THE SARDINAS PATTERSON AND LEVENSHTEIN THEOREMS Scientific Report No. 5
John A. Riley Nov. 1965 33 p refs
(Contract AF 19(628)-3826)
(AFCRL-66-25; AD-629539) CFSTI: HC $2.00/MF $0.50

Complete proofs are supplied for the three theorems, each of which is a basic result in the theory of variable length codes. The residual quotient of two variable length binary codes c, d is defined, and used to construct a certain graded set of the residuals of c with respect to d. In terms of these residuals, a unified treatment is developed. A finiteness condition is considered in relation to codes with bounded delay, and this finiteness condition is applied to synchronizable codes. Some numerical bounds of practical interest are given in connection with the algorithmic aspects of the three theorems. M.G.J.

N66-31343# Stanford Univ., Calif. Dept. of Statistics.
APPROXIMATIONS TO THE DISTRIBUTION FUNCTION OF SUMS OF INDEPENDENT CHI RANDOM VARIABLES
Herman Rubin and James V. Zidek 3 Aug. 1965 12 p refs
(Contract Nonr-225(52))
(TR-106; AD-620288) CFSTI: HC $2.00/MF $0.50

The problem is considered for approximating the distribution function F_n, where there are n independent standard normal random variables. Three well known approximations, the Edgeworth, the Cramer, and a Saddlepoint approximation are described. Another saddlepoint approximation is derived. The problem is discussed of calculating the moment generating function of F_1 for complex values of its argument. The four approximations to F_n are compared for several cases and it is seen that the second saddlepoint approximation yields better results in each case. Author (TAB)

N66-31347*# National Aeronautics and Space Administration, Washington, D. C.
THE HUREWICZ THEOREM [O TEGREME GUREVICHA]
A. V. Zarelua Jul. 1966 20 p refs Transl. into ENGLISH from Mat. Sb. (Moscow), v. 60, no. 1, 1963 p 17–28
(NASA-TT-F-421) CFSTI: HC $1.00/MF $0.50 CSCL 12A

The author presents the Hurewicz theorem for weakly para-compact spaces, with proofs of the theorems and auxiliary propositions in the first part of his work. The second part deals with completely paracompact spaces and decompositions, again with proofs of the theorems and lemmas. Part 3 is concerned with the proofs of the Hurewicz theorem for producing paracompact decompositions. Author

N66-31372*# Maryland Univ., College Park. Computer Science Center.
ON A CLASS OF APPROXIMATE ITERATIVE PROCESSES
James M. Ortega and Werner C. Rheinboldt Jun. 1966 37 p refs
(Grant NsG-398)
(NASA-CR-76394; TR-66-31) CFSTI: HC $2.00/MF $0.50 CSCL 12A

If F is a contractive mapping, then under certain conditions the sequence $x_{n+1}=Fx_n$ tends to the unique fixed-point of F. Because of rounding or discretization error in the numerical evaluation of F, an approximate sequence $\{y_n\}$ is in general produced in place of the exact sequence $\{x_n\}$. In this paper we combine results of Ehrmann, Ostrowski, Schmidt and Urabe, which deal with the behavior of the approximate sequence $\{y_n\}$, into a unified setting and give extension of some of their results. The discussion is set in terms of spaces metricized by elements of a partially-ordered topological linear space. Author

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N66-30007# American Meteorological Society, Boston, Mass.
JOINT RADAR AND AEROLOGICAL OBSERVATIONS IN THE LOWER 1.5 KM OF THE ATMOSPHERE [SOVMESTNYE RADIOLOKATSIONNYE I AEROLOGICHESKIE NABLIUDENIIA V NIZHEM 1,5-KM SLOE ATMOSFERY]
G. B. Brylev, I. V. Vasil'chenko, V. I. Selitskaia, and A. A. Fedorov Bedford, Mass., AFCRL, Mar. 1966 26 p refs Transl. into ENGLISH from Tr. Gl. Geofiz. Observ. (Leningrad), no. 173, 1965 p 76–90
(Contract AF 19(628)-3880)
(T-R-523; TT-66-61159; AD-631967) CFSTI: HC $2.00/MF $0.50

The results of joint radar and aerological observations in the lower 1.5 km of the atmosphere are discussed, and a connection is indicated between radar echoes from a clear sky and convective and turbulent motions in the atmosphere.
Author (TAB)

N66-30008# American Meteorological Society, Boston, Mass.
SOME RESULTS OF RADAR INVESTIGATION OF WIND FIELD STRUCTURE AT HEIGHTS OF 50 TO 700 METERS [NEKOTORYE REZUL'TATY RADIOLOKATSIONNOGO ISSLEDOVANIIA STRUKTURY POLIA VETRA NA VYSOTAKH 50–700 M]
A. G. Gorelik and A. A. Chernikov Bedford, Mass., AFCRL, Mar. 1966 24 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 57, 1964 p 3–18
(Contract AF 19(628)-3880)
(T-R-511; TT-66-61155; AD-631963) CFSTI: HC $1.00/MF $0.50

This paper presents the results of a radar investigation of wind field structure in the atmospheric surface boundary layer. The observational method and results are described, and the latter are compared with the data of other authors. The effect of the entrainment of particles on the results of radar measurements of wind speed variations and the effect of variations of wind speed and direction on the accuracy of Rawin observations are discussed.
Author (TAB)

N66-30185*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
TERRESTRIAL ENVIRONMENT (CLIMATIC) CRITERIA GUIDELINES FOR USE IN SPACE VEHICLE DEVELOPMENT, 1966 REVISION
Glenn E. Daniels, James R. Scoggins, and Orvel E. Smith 1 May 1966 342 p refs
(NASA-TM-X-53328) CFSTI: HC $7.00/MF $1.75 CSCL 04B

This document provides guidelines on probable climatic extremes and probabilities-of-occurrence of terrestrial environment data specifically applicable for NASA space vehicles and associated equipment development. The geographic areas encompassed are: the Eastern test range (Cape Kennedy), Huntsville, New Orleans, the Western Test Range (Point Arguello California), Sacramento, Wallops Test Range (Wallops Island, Virginia), White Sands Missile Range, and intermediate transportation areas. In addition, a section has been included to provide information on the general distribution of natural environment extremes in the United States (excluding Alaska and Hawaii) that may be useful to specify design criteria in transportation of space vehicle components from subcontractors.
Author

N66-30198# Weather Bureau, Washington, D. C. Weather Analysis and Prediction Div.
FORECASTING THE FREEZING LEVEL OBJECTIVELY AS AN AID IN FORECASTING THE LEVEL OF ICING
Jack B. Cox Dec. 1965 21 p ref
(TN-23-FCST-4; PB-169247) CFSTI: $1.00

A new approach was developed to produce forecasts of the base of icing in clouds in as short a time as possible. The approach involves the relation of freezing level versus 1000 to 500 mb thickness values. Scatter diagrams were made relating the thickness field with the freezing level under the influence of cloudy skies as stations both east and west of the Rockies. Results were encouraging and a regression line was constructed. A spring and summer study was made using the same technique and stations. In this case both clear and cloudy skies were used. Results of all these studies are graphically summarized. It is shown that thickness values less than 546 east of the Rockies, and less than 552 in the mountains, indicate the forecasting of icing in all clouds, since these are the Wagner snow versus rain values respectively. In view of the low Wagner snow versus rain thickness values along the western edge of the west coastal area, and the usual instability of the Pacific maritime air that moves into that area, this study is inconclusive for freezing levels below 5000 ft.
R.N.A.

N66-30206*# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
AEROBEE NASA 4.165 UA (21 APRIL 1966) Meteorological Data Report
Marjorie Mc Lardie Hoidale May 1966 35 p refs Prepared for NASA
(NASA-CR-76054; DR-12) CFSTI: HC $2.00/MF $0.50 CSCL 04B

Meteorological data gathered for the launching of Aerobee NASA 4.165 UA are presented for the National Aeronautics and Space Administration, the Johns Hopkins University and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form.
Author

N66-30313# Environmental Science Services Administration, Miami, Fla. National Hurricane Research Lab.
A SIMPLE MODEL OF THE HURRICANE INFLOW LAYER
Banner I. Miller Nov. 1965 17 p refs
(TN-18-NHRL-75; PB-169210) CFSTI: HC $1.00/MF $0.50

A simple numerical model of the hurricane inflow layer has been constructed. A pressure profile representative of an actual hurricane was specified. The effects of turbulent mixing (both vertical and horizontal) and of vertical advection on the field of motion were examined. It was found that the use of an eddy viscosity (K_m) proportional to the pressure gradient force and a surface drag coefficient (C_d) as a function of the surface wind speed resulted in the most realistic meridional circulation. The numerical results were compared with observations obtained in hurricane Donna (1960). The similarity between calculations and observations was satisfactory.
Author

N66-30443# Oklahoma Univ. Research Inst., Norman. Atmospheric Research Lab.
THE THREE DIMENSIONAL LARGE SCALE STRUCTURE OF HURRICANE "DORA" (1964)
Robert C. Sheets Oct. 1965 54 p refs
(Grant NSF-GF-172)
(ARL-1470-1)

The three dimensional large scale structure of a mature hurricane is investigated. The various parameters included in the investigation are temperature, moisture, height anomalies

or D-values, and winds. The wind analysis is separated into various quantities, such as the radial and tangential components, of the observed flow and of the stationary storm. Also included are streamline and isotach analyses, the stationary sotrm mean tangential winds, the relative vorticity computed from these winds, and the steering current components. The steering current principle is tested for selected levels and various radii. Author

N66-30522# Aeronautical Systems Div., Wright-Patterson AFB, Ohio.
PROJECT ROUGH RIDER, 1965, PHASE I-PHASE II Final Summary Report, Apr.-Aug. 1965
Edward Miller Mar. 1966 72 p refs
(ASD-TR-66-3; AD-632610) CFSTI: HC $3.00/MF $0.75

This report states the objectives of Project Rough Rider as well as discusses the test instrumentation used on the penetration F-100F aircraft. Other topics covered are flight operations, aircraft damage, location of archived data, and conclusions and recommendations for future thunderstorm penetrations. This report is documentary or historical in nature and gives an overall picture of Project Rough Rider 1965, but not a detailed analysis of the accumulated data. The various sources from which such analyses can be obtained are referenced in this report. Author (TAB)

N66-30523# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
ELECTRICALLY OPERATED IMPACTORS FOR HYDROMETEOR SAMPLING
Harold W. O'Brien and Motoi Kumai Dec. 1965 21 p refs
(CRREL-TR-170; AD-631950) CFSTI: HC $1.00/MF $0.50

Two model of impactors have been designed for remote sampling of hydrometeors. One, a flashbulb-activated model, is quite suitable for multiple simultaneous sampling, but is prone to occasional mechanical failure. The other, a solenoid-operated model, is almost failure proof but requires considerably more electrical current for multiple simultaneous sampling than does the flash type unit. Results of some laboratory tests on the impactors are shown and field use of the impactors is discussed. The appendix contains electrical specifications for each type of unit. Author (TAB)

N66-30649# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.
METEOROLOGICAL DATA REPORT, AEROBEE AD 3.723 (28 APRIL 1966)
Marjorie Mc Lardie Hoidale 28 Apr. 1966 24 p refs
(DR-17; AD-632845) CFSTI: HC $1.00/MF $0.50

Meteorological data gathered for the launching of Aerobee AD 3.723 are presented for the Air Force Cambridge Research Center, the Colorado University, and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author (TAB)

N66-30661# Battelle Memorial Inst., Columbus, Ohio.
INVESTIGATION OF METHODS TO MEASURE SIZE DISTRIBUTION OF FOG DROPLETS AND CONDENSATION NUCLEI Final Report, 1 Apr. 1962-17 Apr. 1965
Earl J. Shulz, Richard A. Duffee, and Paul G. Andrus 16 May 1966 43 p refs
(Contract AF 19(628)-344)
(AFCRL-65-724; AD-633232) CFSTI: HC $2.00/MF $0.50

This report describes the development of a light-scattering cascade impactor to measure the size distribution of fog droplets in the range from 0.5 micron to 16 microns. The instrument comprises six impaction stages, each equipped with a forward-light-scattering optical system to measure fog droplets of size <16, <8, <4, <2, <1, and <0.5 micron, respectively. An impaction stage to remove particles larger than 16 microns is installed at the instrument intake. Two additional stages are furnished for calibration of the electronic and optical systems. Feasibility of a condensation-nuclei counter based on the principle of electrostatic precipitation was investigated in the laboratory. Author (TAB)

N66-30663# Army Cold Regions Research and Engineering Lab., Hanover, N. H.
HIGH SNOWFIELDS OF THE ST. ELIAS MOUNTAINS YUKON TERRITORY, CANADA
Edward Grew and Malcolm Mellor Mar. 1966 26 p refs
(CRREL-TR-177; AD-633032) CFSTI: HC $1.00/MF $0.50

Observations made during the 1964 summer provide a description of snow and radiation characteristics for the region and give insight into effects of altitude, regarded as a gross variable, when anomalous wind and slope effects are excluded. Divide Camp, Seward Camp, and Lucania Camp were occupied successively within a minimum period of time to compare conditions at different altitudes. Data are presented on snow profiles, snow accumulation measurements, the development of the annual snow layer, snow conditions at depth, the mechanical properties of the snow, snow densification, solar radiation, and the variation of snow properties with surface altitude. It is concluded that as long as local anomalies are avoided, the effects of surface altitude on snow properties and surface processes seem to be simple. However, in mountain regions it is probably a combination of local conditions which produces the most remarkable effects. Author (TAB)

N66-30684# Pennsylvania State Univ., University Park.
RESEARCH IN FOUR-DIMENSIONAL DIAGNOSIS OF CYCLONIC STORM CLOUD SYSTEMS Scientific Report No. 1
Edwin F. Danielson Jan. 1966 62 p refs
(Contract AF 19(628)-4762)
(AFCRL-66-30; AD-632668) CFSTI: HC $3.00/MF $0.75

The rapidly developing storm of 28-30 November 1963 is selected to establish techniques for testing the reliability of various diagnostic procedures. The method of constructing isentropic trajectories is discussed and the results of applying these trajectories to determine average vertical motions and relative humidities are presented. These results which apply at the mid-time between the standard radiosonde releases permit comparisons to both the observed clouds and precipitation. Special intermediate soundings are available which provide a direct check on the advected moisture and an indirect check on the trajectories. Comparisons are also made with machine calculated instantaneous vertical motions. In general, it is found that the vertical motions derived from the isentropic trajectory method provide the greatest resolution and closest agreement with the reported clouds and precipitation. Author (TAB)

N66-30711# Air Force Cambridge Research Labs., Bedford, Mass.
THE ICE FOG PROBLEM AT EIELSON AFB, ALASKA
John H. Taylor and James F. Church Apr. 1966 35 p refs
Its Surv. in Geophys. No. 176
(AFCRL-66-230; AD-632960) CFSTI: HC $2.00/MF $0.50

This report summarizes the findings and conclusions drawn from a survey which was conducted at Alaskan bases. The purpose of the survey was to secure information necessary for making recommendations on the nature and level of effort of research programs which could be directed toward minimizing the disruptive effect of ice fog on air operations at Eielson Air Force Base. The ice fog phenomenon, its principal causes at Eielson, and the nature and extent of its effect on air operations are discussed. An examination is made of engineering approaches to the solution of ice fog problems and their influence on the apparent trend during the past ten years toward a decreasing frequency of occurrence. A recommendation is made for engineering designed to minimize pollutions from what is considered to be the primary source. Finally, there is a discussion of the feasibility of establishing an applied research program designed to provide operationally useful solutions to the ice fog problem. Author (TAB)

N66-30716# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

AEROBEE NASA 4.189 DS (28 APRIL 1966) METEOROLOGICAL DATA REPORT

Marjorie Mc Lardie Hoidale Ft. Monmouth, N. J., Army Electron. Command, May 1966 25 p refs

(DR-15; AD-632844) CFSTI: HC $1.00/MF $0.50

Meteorological data gathered for the launching of Aerobee NASA 4.189 DS are presented for the National Aeronautics and Space Administration, The U. S. Naval Research Laboratory and for ballistic studies. The data appear, along with calculated ballistic data, in tabular form. Author (TAB)

N66-30862# Weather Bureau, Washington, D. C. National Hurricane Research Lab.

A SUMMARY OF EMPIRICAL STUDIES OF THE HORIZONTAL MOTION OF SMALL RADAR PRECIPITATION ECHOES IN HURRICANE DONNA AND OTHER TROPICAL STORMS Technical Note No. 17

H. V. Senn and J. A. Stevens Nov. 1965 70 p refs

(NHRL-74; PB-169248) CFSTI: $3.00

Echo vectors relative to the storm center, obtained by vectorially subtracting storm center motion, are analyzed for 3805 traced echoes from hurricane Donna radar film. Distributions of crossing angle and radial and tangential echo motion components are presented for various storm speeds, quadrants, and ranges from the storm center. Detailed studies show that significant differences in echo motion exist between the echoes which are observed over land and over water, and also between those observed during the nighttime and daytime periods. When the dependence of echo motion on height was studied using height as a function of range from radar, results were inconclusive. However, comparisons of echo and wind kinematics produced significant relationships which varied from quadrant to quadrant. It is also found that outward moving echoes have higher speeds than inward moving echoes in the front quadrants; that echo speeds increase with increasing storm speed; and that the absolute crossing angles of the echoes decrease with increasing storm speed. Echo lifetime studies showed that the longest lived echoes are found in the left quadrants. Author

N66-31128# Douglas Aircraft Co., Inc., Santa Monica, Calif. Missile and Space Systems Div.

THE EVOLUTION OF CUMULUS CLOUDS: A NUMERICAL SIMULATION AND ITS COMPARISON AGAINST OBSERVATIONS Final Report

F. W. Murray and A. B. Hollinden Mar. 1966 154 p refs

(Contract Nonr-4715(00)(X))

(SM-49372; AD-630660) CFSTI: HC $14.60/MF $1.00

Atmospheric thermal convection on the cumulus scale is investigated by numerical solution of the appropriate equations of hydrodynamics and thermodynamics. Initial conditions are based on real or synthetic atmospheric soundings. The one case of synthetic data studied was included to compare the model with a previous simpler model. The other cases are based on actual tropical maritime soundings, two of which correspond with conditions studied by the Naval Research Laboratory by means of instrumented aircraft. The simulated clouds are found to agree in many respects with the real clouds, and in those details in which they disagree possible explanations in terms of limitations of the model and of techniques of aerial observation are discussed. Among the features discussed in some detail are eddy transfer mechanism and the effects of multiple impulses. Recommendations are made for further improvement to the model and for additional field observations. It is concluded that this type of numerical study combined with aerial observation of real clouds offers a very effective method for the study of cumulus dynamics. Author (TAB)

N66-31141# Naval Postgraduate School, Monterey, Calif.

AN EXPERIMENT IN MODIFYING OBJECTIVE 500-mb CONTOUR ANALYSES USING TIROS IX NEPHANALYSES

Theodore C. Casimes and Jerry G. Swor (M.S. Thesis) 1965 69 p refs

(AD-618883) CFSTI: HC $3.00/MF $0.75

One of the numerical operational products of the United States Navy Fleet Numerical Weather Facility (FNWF) is the objective analysis of 500-mb contours on a hemispheric basis. Up to mid 1965, this analysis has been accomplished without use of weather-satellite observations. The period of 14 thru 20 February 1965 is selected as an experimental test period for the purpose of modifying the FNWF 500-mb analyses in the sparse-data region of the central North Pacific Ocean at 00Z. Synoptic scale phenomena depicted on tiros IX nephanalyses are used as basis for the analysis modification. Modified 24- and 48-hour prognoses are made and verified. Results are interpreted in light of the experimental nature of the project, restricted time interval selected and experience level of the authors in the field of satellite meteorology. Author (TAB)

N66-31148# Naval Postgraduate School, Monterey, Calif.

THE DETERMINATION OF RICHARDSON NUMBER AND ROUGHNESS PARAMETER AT OCEAN VESSEL "VICTOR"

Larry M. Riley (M.S. Thesis) 1965 25 p refs

(AD-616530) CFSTI: HC $1.00/MF $0.50

Research on wind and temperature profiles over land have established a number of fundamental relationships that are tested here over an oceanic location. Most attempts at calculating the roughness parameter over oceanic surfaces have been based on surface-layer theories, and often employ an iterative procedure in approaching the sea surface. A similarity relationship between the wind and temperature profiles is employed, using data at ship 'Victor' appropriate to forced convective theory, as defined by Priestley. The theory of forced convection, as applied here, makes it necessary to compute the Richardson number and the Monin-Obukhov scale length as preliminaries to the computation of roughness parameter. The roughness parameter and friction velocity are obtained from the theory using

an iterative procedure. The wind speed at 20 meters is correlated against scale length and roughness parameter. The latter makes very little contribution to the variance of the windspeed while the scale length contributes in a manner reasonably expected from theory. Author (TAB)

N66-31260# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

396 LANCE (MISSILE NO. 031, ROUND NO. 18 RPL) (15 APRIL 1966) Meteorological Data Report

Ft. Monmouth, N. J., Army Electron. Command, May 1966 45 p

(DR-20; AD-633166) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of 396 Lance, Missile Number 031, Round Number 18 RPL, are presented in tabular form. Author (TAB)

N66-31261# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

HONEST JOHN MISSILE NO. 713, ROUND NO. 519 RML (12 APRIL 1966) Meteorological Data Report

Ft. Monmouth, N. J., Army Electron. Command, May 1966 15 p

(DR-23; AD-633219) CFSTI: HC $1.00/MF $0.50

Meteorological data gathered for the launching of Honest John, Missile Number 713, Round Number 519 RML, are presented in tabular form. Author (TAB)

N66-31262# White Sands Missile Range, N. Mex. Atmospheric Sciences Lab.

396 LANCE (MISSILE NO. 035, ROUND NO. 17 RBL) (8 APRIL 1966) Meteorological Data Report

Ft. Monmouth, N. J., Army Electron. Command, May 1966 35 p

(DR-14; AD-632919) CFSTI: HC $2.00/MF $0.50

Meteorological data gathered for the launching of 396 Lance, Missile Number 035, Round Number 17 RBL, are presented in tabular form. Author (TAB)

N66-31285# McGill Univ., Montreal (Quebec). Arctic Meteorology Research Group.

CLIMATE CHANGE OVER THE POLAR OCEAN. I: THE RADIATION BUDGET

E. Vowinckel and Svenn Orvig Jan. 1966 40 p refs *Its* Publ. in Meteorol. No. 79

(Contract DA-19-129-AMC-490(N))

(TR-66-8-ES; AD-632721) CFSTI: HC $2.00/MF $0.50

An analysis is presented of possible changes in the radiative terms of the polar ocean energy budget. Theoretical polar atmospheres are discussed with various changes in the radiation balance. It is concluded that the atmosphere is, at present, adjusted in the best possible way for the conservation of energy. Radiation budgets are presented, for various assumed conditions. The optimum surface conditions would occur with winter overcast and summer clear sky. The earth-atmosphere radiation budget is presented for an open polar ocean. Relatively minor variations in any term can result in a complete freeze-over or complete melting. The atmospheric advection required with an open polar ocean would decrease significantly from the present. It might even become, in winter, a heat export from the polar ocean. Author (TAB)

N66-31276# Naval Oceanographic Office, Washington, D. C.

REPORT OF THE ARCTIC ICE OBSERVING AND FORECASTING PROGRAM, 1964

Dec. 1965 190 p ref

(SP-70(64); AD-628536) Available from Naval Oceanographic Office, Washington, D. C.: $1.50

The ice program conducted by the Oceanographic Office during 1964 is covered by this report. Methods of data collection and dissemination, a report of ice forecasting and reconnaissance, and concomitant ice projects are discussed. A graphic summary of ice data and oceanographic stations collected in the North American Arctic from the Bering Sea to the Denmark Strait is given for January through December. Aerial ice reconnaissance data collected in Canadian and Greenland waters by Canada and Denmark, respectively, and surface and shore observations made by Canadian and United States ships are included. Author (TAB)

N66-31304# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

METEOROLOGICAL-TOWER INDUCED WIND-FIELD PERTURBATIONS (SUPPLEMENT)

G. Hsi and J. E. Cermak May 1966 14 p ref

(Contract DA-AMC-28-043-65-G20)

(CER66GH-JEC26; AD-633353) CFSTI: HC $1.00/MF $0.50

The specific objectives of this supplementary investigation are: (1) to study the mean wind pattern in the neighborhood of a meteorological tower subjected to the same mean ambient wind velocity but at different turbulence levels to determine the effect of turbulence on this mean wind velocity pattern; (2) to acquire measurements of wind speed at the anemometer position (boom mounted) for all possible wind directions. Author (TAB)

N66-31336# Navy Electronics Lab., San Diego, Calif.

REFRACTION OF REAL TROPOSPHERE AND OF CRPL REFERENCE ATMOSPHERE COMPARED Research Report, Nov. 1964–Nov. 1965

C. H. Sheddy 2 Feb. 1966 212 p refs

(NEL-1352; AD-633417) CFSTI: HC $6.00/MF $1.25

The CRPL reference atmosphere was evaluated on the basis of comparison with radiosonde data taken at both coastal and ocean weather stations in the southeastern North Pacific. Results indicate that corrections for angular aiming errors due to refraction can be made rather accurately at the ocean weather stations by use of the CRPL reference atmosphere. Selected calculations, in the form of a set of 202 figures, include seasonal trends, variation of refraction with elevation angle and height of satellite, and incidence of ducting. TAB

N66-31337# Office of Naval Intelligence, Washington, D. C. Translations Section.

RESEARCH IN THE OCEAN 33RD TRIP OF VITYAZ

O. A. Kuznetsov [1964] 5 p Transl. into ENGLISH from Tr. Inst. Okeanologii, Akad. Nauk SSSR (Moscow), v. 64, 1964 p 154–157

(ONI-TRANS-1034; TT-66-61268; AD-633087) CFSTI: HC $1.00/MF $0.50

The development and improvement of gradient measurements from a semi-automatic buoy is reported. TAB

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N66-30068# Joint Publications Research Service, Washington, D. C.

GYROSCOPIC AND NAVIGATION INSTRUMENTS: SOME ERRORS IN INERTIAL NAVIGATION SYSTEMS

E. I. Sliv, Ye. V. Safonova, and A. D. Il'yicheva *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 145–149 (See N66-30046 17-10) CFSTI: $5.00

This article treats the problem of the effect of inaccurately compensating for acceleration due to the earth's gravitational force on the accuracy in determining the coordinates of a moving body using an inertial navigation system. Author

N66-30071# Joint Publications Research Service, Washington, D. C.

OPTIMIZING COMBINED INERTIAL NAVIGATION SYSTEMS

Ye. P. Churakov *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 164–170 refs (See N66-30046 17-10) CFSTI: $5.00

This article proposes a method of statistical optimization combined with respect to velocity of an inertial navigation system on the basis of the Phillips theory. Comparisons are made of the precision characteristics of an optimum combined system and an uncorrected inertial system when the same elements are used. Author

N66-30526*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

LINEAR FEEDBACK GUIDANCE

Lyle R. Dickey 30 Nov. 1965 60 p refs

(NASA-TM-X-53382) CFSTI: HC $3.00/MF $0.50 CSCL 17G

The problem of determining the coefficients for a linear feedback guidance system with polynomial gains is investigated. The solution to linearized motion equations is used to determine the first partial derivatives of the optimum thrust angle deviations with respect to position and velocity coordinates. The partial derivatives are approximated by quadratic time functions, which are the first approximation to a time-variable set of gains. This system is then analyzed, and two of the weighting functions are linearized with respect to perturbations in the polynomial coefficients. Changes in these coefficients are determined to minimize the weighted sum of squares of these expressions over several time points. The resulting changes were made, and a satisfactory reduction in magnitude of these weighting functions resulted. This, coupled with a linear feedback of thrust acceleration and a small time function derived to cancel the effect of initial conditions, produced the final guidance function which performed exceptionally well on a 100 n.m. orbital mission of an early SA-8 second stage vehicle. Author

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N66-30206# Atomic Energy Commission Research Establishment, Riso (Denmark).

INSTRUMENTATION AND CONTROL OF POWER PLANTS. A REVIEW [AUTOMATISERING AF KRAFTVAERKER. EN OVERSIGT]

Poul Nielsen Sep. 1965 32 p refs In DANISH; ENGLISH summary

(RISO-M-312)

A review of trends in instrumentation and control of power plants is presented. Special attention is given to the problems involved in using process computers and wired program system made of solid-state logic modules. Details are given of both systems as applied to instrumentation and control of turbines. Author (NSA)

N66-30220# Babcock and Wilcox Co., Lynchburg, Va. Nuclear Development Center.

RADIOCHEMISTRY OF NUCLEAR FUELS Quarterly Progress Report No. 3, 1 Feb.–30 Apr. 1965

W. N. Bishop and E. H. Dewell [1965] 43 p refs

(Contract AT(30-1)-3376)

(BAW-296) CFSTI: HC $2.00/MF $0.50

Problems involved in calculating reactor fuel burnup were studied, and equations that relate the experimental measurements to burnup were derived. The conditions that are required for using simplified expressions for burnup are given. The neutron flux and exposure time conditions under which several possible burnup monitors are useful were determined. The parameters whose errors significantly affect the error in burnup were found for various exposure conditions and for several monitors. Author (NSA)

N66-30223# Japan Atomic Energy Research Inst., Tokyo.

CENTRALIZED FIELD RADIOLOGICAL MONITORING SYSTEM AT NUCLEAR INSTALLATION

Toyohide Ishihara Jun. 1965 46 p refs In JAPANESE; ENGLISH summary

(JAERI-1090)

In the normal operations, radioactive gases and liquids are released from nuclear installations, considering the environmental conditions in the dispersion and dilution of the radioactive substances. There is also the possibility that the populace around are exposed to the radiation at the time of an accident of such nuclear installations. In both cases of the above, the field radiological monitorings are required. The evaluation of the reactor hazards shows that, in the case of major accidents, adequate procedures must be taken within a few hours of the accident in order to minimize the radiation exposures. In this connection, it is desirable to maintain an effective radiological monitoring system, which detects the unusual conditions of radioactivity and permits the adequate steps of radiation control, thus minimizing the radiation hazard from the accident and also compensating for the unfavorable site conditions. Included are the requirements of such field monitoring, theoretical

analysis of the monitoring system used when the radioactive substances are released into the atmosphere, detailed design of the system, and the development of the centralized field monitoring system and required equipment. Author (NSA)

N66-30407# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.
IN-PILE LOOP IRRADIATION STUDIES OF ORGANIC COOLANT MATERIALS Progress Report, 1 Jan.–30 Sep. 1965
D. T. Morgan 1 Nov. 1965 35 p refs
(Contract AT(38-1)-334)
(MIT-334-33) CFSTI: HC $2.00/MF $0.50

Irradiation of Santowax WR in the MITR in a new fuel position with a fast neutron fraction of 0.05–0.06 was initiated until the terphenyl concentration had decreased from 92% to a level of 84% as desired for Run 14. Steady-state Run 14 was started on July 19 and continued to September 27, 1965, with distillation processing and recycle of the coolant. The operating conditions and the preliminary G* (-omp) values from these runs are summarized. At the end of Run 14, a tritium dilution for the circulating organic mass was carried out. A reevaluation of previous loop data was carried out and G values calculated for individual terphenyl isomers as well as the total terphenyl and high boiler. Heat transfer and friction factor measurements using a new test heater were performed. All previous data as well as the new data were compared with the Dittus–Boelter and Colburn relations. The heat transfer data agreed with either correlation within ±10%; the friction factor data agreed with the Colburn relation within ±10%. Calorimeter and foil activation measurements were carried out in the new experimental facility to establish the dose rate. NSA

N66-30409# Aerojet-General Nucleonics, San Ramon, Calif.
ARMY GAS-COOLED REACTOR SYSTEMS PROGRAM. STUDIES OF HASTELLOY X CORROSION IN AIR AT 1900 AND 2000°F
J. S. Brunhouse Dec. 1965 31 p refs
(Contract AT(10-1)-880)
(AGN-TM-414) CFSTI: HC $2.00/MF $0.50

An evaluation of the corrosion resistance of Hastelloy X sheet and tubing materials at 1900° and 2000°F in air was undertaken to establish limiting oxidation rates and physical metallurgical changes in an effort to define the limiting lifetime/temperature characteristics of this material. Test specimens were to be exposed in air for 100, 1000, 2500, 5000, 7500, and 10,000 hr durations or until the time limitations were established. It appears that Hastelloy X would probably be useful as a fuel cladding for reasonably long periods of time in 1900°F air although specific limiting criteria need to be developed. At 2000°F, however, rapid oxidation and strength decreases would probably limit the service life of the material to a few thousand hours. NSA

N66-30415# Oak Ridge National Lab., Tenn.
THE MANUFACTURE OF THE CONTROL RODS FOR THE EXPERIMENTAL GAS-COOLED REACTOR
G. M. Tolson Apr. 1966 23 p refs
(Contract W-7405-ENG-26)
(ORNL-3932) CFSTI: HC $2.00/MF $0.50

The Experimental Gas-Cooled Reactor, now under construction at Oak Ridge, Tennessee, is a nuclear reactor designed to provide both power demonstration and experimental testing. The control rod consists of four segments held together by a spring-loaded central rod. The lower three segments contain B_4C bushings in an annulus between two concentric tubes. The rods are sufficiently flexible to allow movement should the channel in which they travel become distorted. Type 304 stainless steel is used to encase the B_4C, and type 347 stainless steel is used for structural members. To prevent reaction with the B_4C, all of the stainless steel in contact with B_4C was copperplated. Manufacturing methods, inspection, and assembly of the components are described. Thus far 25 control rods have been successfully produced. Author (NSA)

N66-30418# Battelle-Northwest, Richland, Wash. Physics and Instruments Dept.
PHYSICS RESEARCH QUARTERLY REPORT, JULY, AUGUST, SEPTEMBER, 1965
J. R. Worden et al 15 Oct. 1965 65 p refs
(Contract AT(45-1)-1830)
(BNWL-193) CFSTI: HC $3.00/MF $0.75

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N66-30419# Battelle-Northwest, Richland, Wash.
STRESSES IN ZIRCALOY-2 CLADDING DURING VIBRATORY FUEL LOADING
R. L. Gibby and R. J. Lobsinger Mar. 1966 16 p refs
(Contract AT(45-1)-1830)
(BNWL-194) CFSTI: HC $1.00/MF $0.50

Longitudinal vibration of EBWR tubes during fuel loading excites transverse vibrational modes in the tube. These stresses are great enough to cause fatiguing of the Zircaloy-2 during the final stages of fuel powder loading. With a standard clamp, the end-cap crevice acts as a stress raiser and fatigue failure can occur at lower stress values. A modified tapered end clamp with nylon insert is very effective in reducing fatigue failures by relocating major stresses to the heavier cladding. Reinforcement of the resonance plate is undesirable because it increases the integrated fatigue stress level. NSA

N66-30423# Los Alamos Scientific Lab., N. Mex.
FISSION-COUPLES APPLIED TOWARD REACTOR DIAGNOSTICS AND SAFETY

R. G. Morrison and D. B. Stillman 16 Apr. 1966 31 p
(Contract W-7405-ENG-36)
(LA-3470-MS) CFSTI: HC $2.00/MF $0.50

A technique was developed for the Kiwi Transient Nuclear Test which used fissile material as a sensing element for reactor transient measurements and detailed fuel studies. This was done by welding very small thermocouple leads to the actual fuel material and forming an "intrinsic" junction. The response of this sensor has given accurate measurements of the reactor periods as short as 15 μsec. A hypothesis is discussed that the heat produced by fission fragments in the fissile material can be monitored with sufficient accuracy to form a direct measurement of reactor power. Author (NSA)

N66-30425# Los Alamos Scientific Lab., N. Mex.
RADIATION MEASUREMENTS OF THE EFFLUENT FROM THE KIWI TNT EXPERIMENT
R. W. Henderson and R. V. Fultyn Apr. 1966 42 p refs
(Contract W-7405-ENG-36)
(LA-3395-MS) CFSTI: HC $2.00/MF $0.50

Included is a compilation of data resulting from the collection of samples of, and direct measurements of, the effluent cloud from the Kiwi Transient Nuclear Test experiment. Data are presented concerning the magnitude and isotopic composition of the airborne and ground deposited material at distances from 4,000 feet to 50 miles from the test point. Data from samples collected by cascade type impactors are given. Film dosimetry radiation measurements taken at the various stations are presented. A brief description of equipment and techniques used in the reduction is included. An appendix gives the true distance and azimuth of each sampling station with regard to the TNT test point. Author (NSA)

N66-30468# Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.
DEVELOPMENT AND TESTING OF A TEMPERATURE TRANSIENT METHOD FOR PERFORMING IN-PILE THERMAL CONDUCTANCE TESTING Progress Report, 1 Jul.–30 Sep. 1965
C. E. Burdg and S. S. Christopher Oct. 1965 20 p
(Contract AT(30-1)-3336)
(CEND-3336-251; EURAEC-1510) CFSTI: HC $1.00/MF $0.50

The concept investigated is one whereby measurement of the transient temperature response at the surface of an operating fuel element, following a reactor power change, will yield thermal conductance values. This two-phase investigation consists first of out-of-pile demonstrations of feasibility followed by in-pile confirmation of the method. Concurrent mathematical analyses of the thermal model will provide the bases for data interpretation, as well as guides for the design of the experimental portions of the program. Installation of a lowpass filter in the cladding thermocouple signal path has resulted in significant improvement in the signal/noise ratio. Tests of a ZrO_2 element, using square wave cyclic input, have yielded anomalous results. The phase shift of the cladding temperature response with regard to the input signal appears to be different at different locations along the length of the element, by an amount not fully explained by recognizable uncertainties in measurement. However, the fuel was of low density (72% of theoretical) and inhomogeneities or cracks may be responsible for this anomalous behavior. Author (NSA)

N66-30579# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.
STRESS CORROSION IN ALLOYS FOR FUEL ELEMENT CLADDING—STAINLESS STEEL AND ZIRCALOY
K. C. Thomas and R. J. Allio Sep. 1965 136 p refs
(Contract AT(30-1)-3269)
(WCAP-3269-50) CFSTI: HC $4.00/MF $1.00

Studies were made to determine the factors responsible for the stress corrosion failure of stainless steel and Zircaloy-4 fuel element cladding so that they can be controlled and the susceptibility to failure minimized. At room temperature, Zircaloy-4 and crystal bar zirconium were found to be susceptible to brittle failure when stressed at 30,000–50,000 psi (2,109–3,515 kg/cm^2) in aqueous solutions of up to 20 wt % ferric chloride, having a pH of 0.6. The time of failure decreased with increases in stress, increase in chloride solution concentration, and increase in hydrogen content of the metal. The failures observed in zirconium alloys containing hydrogen are explained by a mechanism that involves the initiation of cracks in the hydride phase by piled-up groups of dislocations. Increase in strain at a given temperature, and increase in temperature at a given strain increased the dislocation density of 304 stainless steel and Incoloy 800. The time to failure of 304 stainless steel, in boiling magnesium chloride solution, at 40,000 psi was less than 1 hr, whereas failure did not occur in Incoloy 800 in less than 350 hr under similar conditions. NSA

N66-30592*# Oak Ridge National Lab., Tenn.
ABSTRACTS OF DIGITAL COMPUTER CODE PACKAGES ASSEMBLED BY THE RADIATION SHIELDING INFORMATION CENTER
Betty F. Maskewitz [1966] 183 p refs
(NASA Order R-104; DASA Order EO-804-66)
(NASA-CR-76199; ORNL-RSIC-13) CFSTI: HC $5.00/MF $1.25 CSCL 18F

A collection of digital computer code package abstracts for use in radiation shielding calculations is presented. The abstracts include the code package name and code title, auxiliary routines, contributors, coding language and computer, nature of the problem solved, method of solution, restrictions or limitations, typical running time, computer hardware and software requirements, references, contents of the code package and information on how to obtain the code package. The code packages are also indexed alphabetically, categorically by calculational techniques, and numerically with title, contributor, and primary reference. R.N.A.

N66-30788# Sandia Corp., Albuquerque, N. Mex.
POODLE THRUSTER AERODYNAMIC DROP TEST
W. D. Dalby Apr. 1966 161 p refs
(Contract AT(29-1)-789)
(SC-RR-65-609) CFSTI: HC $5.00/MF $1.00

Ten TRW Systems Poodle Thrusters were dropped at Tonopah Test Range to obtain aerodynamic data. The information obtained will be directly applicable to the safety analyses of the Poodle System. The Poodle Thruster models dropped were all 16.5 inches long and had a body diameter of 2.85 inches. Five had a fin span of 13.720 inches and weighed approximately 61.5 pounds; five had a span of 5.750 inches and weighed approximately 32.5 pounds. All aerodynamic data were obtained by optical coverage. Roll rates observed were 835 to 2940 rpm and 1450 to 1925 rpm for the larger span and smaller spans, respectively. Corresponding tumble rates were 0 to 1185 rpm and 15 to

580 rpm. Maximum velocities of 230 and 290 fps were noted for the larger and smaller span models, respectively. The corresponding values for C_DS were 1.44 to 1.80 and 0.450 to 0.510 square feet. Author (NSA)

N66-30770# Bettis Atomic Power Lab., Pittsburgh, Pa.
THE HOMOGENIZATION AND DENSIFICATION OF ZrO_2+ UO_2 FUELS UNDER IRRADIATION
R. M. Berman Jan. 1966 63 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-301) CFSTI: HC $3.00/MF $0.75

Plates of ZrO_2+36.8 wt/% UO_2 and ZrO_2+46 wt/% UO_2 initially 90, 80, and 70% theoretical density (T.D.), were clad in Zircaloy and irradiated to various burnups from 1 to 6×10^{20} fissions/cm^3 in a pressurized loop in the MTR. Post-irradiation examination showed that the porosity collapsed under the loop pressure during irradiation. In ZrO_2+46 wt/% UO_2, large, elongated pores became strings of small spherical pores; in ZrO_2+36.8 wt/% UO_2, they became zones of microporosity. The plates reached a minimum thickness at about 4×10^{20} fissions/cm^3 for ZrO_2+ 36.8 wt/% UO_2. Thereafter, they began to expand as fission gases accumulated. X-ray diffraction showed that the two phases initially present in ZrO_2+46 wt/% UO_2 had homogenized by 5×10^{20} fissions/cm^3. The process of homogenization can be satisfactorily defined by a diffusion equation, if a value for the diffusion constant $D=3.32\times10^{-14}$ cm^2/sec is used. This D value indicates that a single fission homogenizes a volume containing 1.66×10^7 atoms. This number is two orders of magnitude too large to be explained by Brinkman's displacement spike hypothesis. Calculations based on Konobeevsky's hypothesis of a thermal pulse show that the liberation of 23 Mev of thermal energy at the center of such a volume is sufficient to cause homogenization. This seems well within the capabilities of a fission event.
Author (NSA)

N66-30779# New Mexico Univ., Albuquerque. Sandia Corp., Albuquerque, N. Mex.
ROVER DESTRUCT TEST THREE. ABERDEEN PROVING GROUND Final Report
T. T. Castonguay, T. B. Anderson, and R. C. Bower Albuquerque, N. Mex., Sandia Corp., Dec. 1965 15 p ref Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-CR-66-2017)

Particle collection and sizing are reported from the ROVER destruct test. These data are expected to provide a few of the inputs to a computer program designed to analyze particle distribution from a space destruct of the ROVER/NERVA propulsion engine. These data were obtained from polystyrene blocks containing graphite particles, which were dissolved in trichloroethylene. The graphite particles were collected, cleaned and sized through a series of Tyler sieves. Graphite particles embedded in rotating polystyrene plastic were also recovered and sized, but prior to dissolving, the angle of entry and depth of penetration were tabulated. Author (NSA)

N66-30782# Battelle-Northwest, Richland, Wash. Ceramics and Graphite Research Section.
IRRADIATION-INDUCED CONTRACTION OF GRAPHITES AT HIGH TEMPERATURE FOLLOWING COLD PREIRRADIATION AND INTERMITTENT THERMAL ANNEALS
J. H. Cox and E. M. Woodruff Jan. 1966 17 p refs
(Contract AT(45-1)-1830)
(BNWL-215) CFSTI: HC $1.00/MF $0.50

Defects were nucleated in KC, CSF, and TSGBF reactor-grade graphites by irradiation at 30°C to exposures of 2.9×10^{20} nvt (E>0.18 Mev). The samples were thermally annealed to 750°C and irradiated again at 550° to 700°C to exposures of 11.1×10^{20} nvt. This treatment increased the contraction rate of the graphites by a factor of 3.2 ± 1.0. The contraction rate was independent of orientation. Samples of TSX graphite were irradiated at different temperatures and exposures to 3.0×10^{21} nvt; after each irradiation the samples were annealed to approximately the graphitization temperature. In each case, the contraction upon subsequent irradiation was less in the annealed samples. NSA

N66-30783# Mound Lab., Miamisburg, Ohio.
REACTOR FUELS AND MATERIALS DEVELOPMENT PLUTONIUM RESEARCH Research and Development Report, Jul.–Sep. 1965
L. J. Wittenburg and G. R. Grove 11 Mar. 1966 22 p refs
(Contract AT(33-1)-GEN-53)
(MLM-1301) CFSTI: HC $2.00/MF $0.50

Continued study in the Ce–Fe binary system showed the existence of the compound $CeFe_7$ instead of the compound identified in the literature as $CeFe_8$. The Pu–Ce–Fe ternary phase diagram was modified to show this change. An extensive terminal solid solution of Pu in Ce_8Ni_2 was shown to extend to 45 at. % Pu. The solid solution has no significant homogeneity range with regard to Ni content. The viscosities of liquid Sn, Pb, and U were determined with the liquids contained in zirconia crucibles to prevent corrosion of the viscosity capsules. Viscosity measurements on liquid U indicated 7.6 centipoise at the melting point, 1133°C, and 6.2 centipoise at 1223°C. Microscopic examination of an arc-melted pellet of PuO_2 showed the formation of the eutectoid structure of PuO_{2-x} and alpha Pu_2O_3. In several noneutectoid phase areas large acicular crystals of alpha Pu_2O_3 had formed in a matrix of PuO_{2-x}
NSA

N66-30784# Atomics International, Canoga Park, Calif.
RADIOLOGICAL ASPECTS OF REENTRY BURNUP OF SNAP REACTORS
C. A. Willis 25 Mar. 1966 43 p refs
(Contract AT(11-1)-GEN-8)
(NAA-SR-11781) CFSTI: HC $2.00/MF $0.50

Reentry burnup of SNAP reactors may produce low levels of worldwide fallout. The International Commission on Radiological Protection has recommended a population dose limit of 2 rem in 30 yr. The factors affecting the choice of a population dose criterion are reviewed in this report. These factors include radiological safety history and tradition, radiobiological knowledge, other radiation criteria, and the biological significance of criteria doses. No safety justification is found for reduction of the ICRP limit. This 2-rem in 30-yr dose is well within the range of variation of natural background radiation. Population safety requirements are satisfied if the dose is less than the ICRP criterion. Many possible sources of artificial, nonmedical radiation could contribute to the population dose. For planning purposes, it is recommended that one-eighth the population dose, 0.25 rem/30 yr, be taken as the allowable dose from SNAP reactor applications. Author (NSA)

N66-30808# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
SNAP-15A RADIOISOTOPE THERMOELECTRIC GENERATOR

R. J. Campana 1 Oct. 1965 17 p refs Presented at Inst. of Elec. and Electron. Engr. 12th Nucl. Sci. Symp., San Francisco, 18–20 Oct. 1965
(Contract AT(04-3)-167)
(GA-6695; CONF-651001-4) CFSTI: HC $1.00/MF $0.50

The design and development of the SNAP-15A thermoelectric generator are described. The performance of the 15A is compared with semiconductor and metal thermocouples. Test results to data, a safety and hazards evaluation, and a description of uses and applications are included.
NSA

N66-30820# Portugal. Nuclear Energy Commission, Sacavem. Lab. of Physics and Nuclear Energy.
CONSTRUCTION AND UTILIZATION OF SMALL-DIMENSION FISSION CHAMBERS [CONSTRUCAO E UTILIZACAO DE CAMARAS DE CISAO DE PEQUENAS DIMENSOES]
Glenn S. Brunson, Luis Amaral Afonso, and José Francisco Salgado 1964 12 p refs In PORTUGUESE Presented at 27th Portugo-Spanish Conf. for the Progr. of Sci., Bilbao, Spain, 20–24 Jul. 1964
(LFEN-NI-19)

The construction of a small fission counter using Al was described. The characteristics of the counter using filling gases of nitrogen, carbon dioxide, or commercial propane were determined.
NSA

N66-30827# Nuclear Materials and Equipment Corp., Apollo, Pa.
DEVELOPMENT AND TESTING OF UO_2–PuO_2 FAST REACTOR FUELS Progress Report, Jul. 1–Sep. 30, 1965
22 Nov. 1965 32 p
(Contract AT(30-1)-3524)
(NUMEC-3524-8) CFSTI: HC $2.00/MF $0.50

Calculations of the film and capsule wall temperature drop for a fixed diameter of the fuel pins for the 4th and 5th rows in the EBR II Stagnant Sodium Capsule Test are given. Coprecipitated UO_2–15 wt. % PuO_2 fuel was found to have a better Pu and U homogeneity than mechanically mixed fuel. Extrusion tests of UO_2 with ethyl cellulose as the binder and perchlorethylene as the liquid failed to yield acceptable green and fired densities. The binder-liquid combination methyl cellulose–ammonium alginate–water yielded satisfactory green densities and low extrusion pressures after extended mixing. Results indicate that mixing is the most critical operation in the preparation cycle and that if inadequately or incorrectly performed, excessive extrusion pressures and low densities result.
NSA

N66-30840# National Lead Co. of Ohio, Cincinnati.
THE EFFECTS OF VARIOUS FABRICATION VARIABLES ON TEXTURE GRADIENTS IN URANIUM FUEL CORES
P. E. Henry 4 May 1965 16 p refs Presented at the AEC Preferred Orientation Meeting, Hanford, Wash., 25 Feb. 1965
(Contract AT(30-1)-1156)
(NLCO-945; CONF-650210-4) CFSTI: HC $1.00/MF $0.50

Uranium fuel cores produced by various fabrication processes and having different heat treatments were evaluated by X-ray diffraction to determine the effect of geometry, heat-treatment quenching media, and certain fabrication characteristics on theoretical growth indexes. These indexes were used to predict the anisotropic growth tendencies of the cores under irradiation by thermal neutrons. A shorter method of investigating texture gradients in the longitudinal, circumferential, and radial direction by examination of only three points across the core wall is discussed.
Author (NSA)

N66-30842# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
REDUCTION POSSIBILITIES OF SOME ERRORS IN THE β-ACTIVITY MEASUREMENTS BY THE SOLID ANGLE METHOD [PRZY POMIARACH AKTYWNOSCI PREPARATOW β-PROMIENIOTWORCZYCH METODA STALEJ GEOMETRII]
K. I. Zharnovetski [1965] 22 p refs In POLISH
(INR-817/XIX/D)

The influence of some factors on the diminution of accuracy in β-activity measurements by the solid angle method is examined. Special attention is paid to the accurate assessment of the solid angle value and to the effects of scattering and absorption of particles in the shield and in air. Practical advice is given on methods for gaining an accuracy that is only little less than that offered by other special methods that are time consuming and require complex equipment.
Author (NSA)

N66-30891# Institut for Atomenergie, Kjeller (Norway).
THE FORTRAN VERSION OF THE NEUTRON THERMALIZATION CODE K-7 THERMOS FOR THE CDC-3600 COMPUTER
R. J. J. Stamm'ler Feb. 1965 14 p refs Sponsored jointly with Reactor Centrum Nederland.
(KR-101)

The basic properties of the neutron transport and thermalization code K-7 THERMOS are described. This is a multiregion and multigroup code which solves the space and energy dependent integral transport equation in an infinitely long heterogeneous reactor cell with cylindrical symmetry and a reflective, white, or black outer boundary. Three types of moderator are allowed, light and/or heavy water, oxygen, and graphite. The free-gas model is used for oxygen and graphite, while for hydrogen and deuterium the choice is either the free-gas model with effective masses, or the Nelkin model, or an anisotropic version of the latter due to Koppel and Young. The code is provided with a cross section library which makes the input system extremely simple.
Author (NSA)

N66-30936# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
GARGOYLE—AN INFINITE MEDIUM FUEL CYCLE ANALYSIS CODE WITH FUEL AND POISON SEARCHES
F. W. Todt 12 Feb. 1966 156 p refs
(Contract AT(04-3)-167)
(GA-6622) CFSTI: HC $5.00/MF $1.00

GARGOYLE employs a flexible nuclide scheme (specified by input) and depletes up to 12 fuel regions (fuel types or stages of irradiation) by subjecting them all to the same average flux. A control poison search may be performed at each time step. Feed material searches may be performed at the end of each burnup cycle before refueling. Any nuclide or combination of nuclides may be included in the feed search. Any nuclide or combination of nuclides may be completely or partially recycled in accordance with input specifications. Concentration-dependent self-shielding factors may be applied to any nuclide. The current restrictions of the program are: 12 energy groups, 3 nuclides with thermal transfer matrix (moderators), 12 fuel types or regions, 40 nuclides per region, and 25 heavy nuclides (producing fission products).
NSA

N66-30937# Combustion Engineering, Inc., Windsor, Conn. Nuclear Div.

DEVELOPMENT AND TESTING OF A TEMPERATURE TRANSIENT METHOD FOR PERFORMING IN-PILE THERMAL CONDUCTANCE TESTING Final Summary Report, Mar. 1, 1964–Nov. 30, 1965

C. E. Burdg, J. R. Parrette, R. I. Brockett, and W. P. Chernock Jan. 1966 98 p refs

(Contract AT(30-1)-3336)

(CEND-3336-260; EURAEC-1567) CFSTI: HC $3.00/MF $0.75

The objective of the program was to develop a method of measuring the effective thermal conductivity of an operating nuclear fuel element, by analysis of the transient temperature response at the surface of the cladding following a change in the power level. The two-phase study was designed to first conduct out-of-pile experiments to demonstrate feasibility of the methods, followed by in-pile confirmation. Concurrent mathematical analyses of the thermal models provided the bases for data interpretation as well as guides for the design of the experiments. The various experiments performed and their results are discussed. NSA

N66-30938# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

BEHAVIOR OF A PRE-STRESSED CONCRETE PRESSURE VESSEL SUBJECTED TO A HIGH-TEMPERATURE GRADIENT [COMPORTEMENT D'UN CAISSON EN BETON PRECONTRAINT SOUMIS A UN GRADIENT DE TEMPERATURE ELEVE]

Frederic Dubois, Charles Bonvalet, Guy Dawance, and Jean-Claude Marechal Dec. 1965 97 p refs In FRENCH

(CEA-R-2829)

After a review of the problems presented by pressure-vessels for atomic reactors (shape of the vessel, openings, foundations, etc.) the advantages of prestressed concrete vessels with respect to steel ones are given. The use of prestressed concrete vessels, however, presents many difficulties connected with the properties of concrete. Thus, because of the absence of an exact knowledge of the material, it is necessary to place a sealed layer of steel against the concrete, to have a thermal insulator or a cooling circuit for limiting the deformations and stresses, etc. It follows that the study of the behavior of prestressed concrete and of the vessel subjected to a high temperature gradient can yield useful information. A one-tenth scale model of a prestressed concrete cylindrical vessel without any side openings and without a base was built. Theoretical aspects concerning scale model-actual structure similitude conditions and the calculation of the thermal and mechanical effects are discussed. The prestressed concrete model was heated internally by a pyrotenax element and cooled externally by a very strong air current. The concrete was prestressed using horizontal and vertical cables held at 80 kg/cm^2, the thermal gradient was 160°C. During the various tests, measurements were made of the overall and local deformations, the changes in water content, the elasticity modulus, the stress and creep of the cables and the depths of the cracks. The overall deformations observed are in line with thermal deformation theories and the creep of the cables attained 20 to 30% according to their position relative to the internal surface. The dynamic elasticity modulus decreased by half but the concrete retained its good mechanical properties. Finally, cracks 8 to 12 cm deep and 2 to 3 mm wide appeared in that part of the concrete which was not prestressed. The results obtained make it possible both to draw up a program for future tests and to propose a calculation model for prestressed concrete pressure-vessels. Author (NSA)

N66-30943# Kernforschungszentrum, Carlsruhe (West Germany)

STUDY GROUP FOR DEEP STORAGE OF RADIOACTIVE WASTE [STUDIENGRUPPE FUER TIEFLAGERUNG RADIOAKTIVER ABFAELLE] Annual Report, 1964

H. Krause and H. Ramdohr May 1965 26 p refs In GERMAN

(KFK-357)

Studies of the development of safe and economic methods for the long-term removal of radioactive waste and for the design and construction of an installation for the final collection and processing of radioactive wastes are reported. The basic concepts used in the determination of the requirements for long-term storage of radioactive wastes are reported. Experimental work on the storage of radioactive wastes in salt caverns is described. The economic and safety factors to be considered in the disposal of waste under the sea were also considered. NSA

N66-30947# India. Dept. of Atomic Energy, Bombay.

REVIEW OF NUCLEAR DATA RELATED TO THORIUM FUEL CYCLE

R. Shankar Singh 1965 10 p refs

(AEET-234)

A knowledge of accurate and reliable nuclear data for the materials in any fuel cycle is essential in assessing its technical feasibility and economic potential. The nuclear parameters, in which a reactor physicist is usually interested, are discussed for the heavy elements associated with the thorium cycle, such as ^{232}Th, ^{233}U, ^{233}Pa, and ^{234}U and the fission products. The existing data for these materials and the gaps that have to be filled up are described. Temperature dependent effective group capture cross sections for thorium, which were evaluated with the available resonance parameters, are also tabulated. Author (NSA)

N66-30971*# Oak Ridge National Lab., Tenn.

SNAP-8 CORROSION PROGRAM Quarterly Progress Report, Period Ending May 31, 1965

H. W. Savage, E. L. Compere, R. E. Mac Pherson, W. R. Huntley, and A. Taboada Sep. 1965 22 p refs

(NASA Order C-220-A; Contract W-7405-ENG-26)

(NASA-CR-76382; ORNL-3859) CFSTI: HC $2.00/MF $0.50 CSCL 18N

Operation of the final loop (14-4) in the present phase of the corrosion program with continuous cold trapping and deuterium injection was completed. The objectives were to ascertain differences in corrosion and mass transfer rates resulting from continuous cold trapping and to evaluate the effectiveness of cold trapping in reducing the H_2 concentration in the NaK and thus the H_2 effluent from the loop. The loop operated for 2659 hr at design temperature prior to shutdown. The hydride trap for collecting extraneous H_2 operated for 500 hr, and the deuterium trap operated for 676 hr. The introduction of deuterium into the loop successfully served to distinguish between extraneous H_2 and that injected into the loop. The deuterium data indicated that the equilibrium pressure in the loop is approximately the same as the calculated H_2 partial pressure for the SNAP-8 primary system in space (2.4×10^{-5} atm). Results of analytical examinations on all but loop 14-4 generally confirmed previous observations. Very little metal migration occurred in low-O_2 content NaC at both temperature levels investigated; however, C migration was severe. Corrosion of the Fe-base alloys in the low-O_2 content NaK was very low, as compared with corrosion of the chromized Hastelloy N, which ranged from three to seven times as

great. Sheet tensile specimens of Croloy 9M were decarburized to a C content of approximately 0.002 to 0.01%. As shown previously, there was general deterioration of mechanical properties. NSA

N66-30982# Los Alamos Scientific Lab., N. Mex.
ADVANCED CONCEPTS FOR NUCLEAR PROPULSION AND RELATED PROBLEMS IN HIGH TEMPERATURE CHEMISTRY
Melvin G. Bowman [1966] 7 p Presented at Meeting on Current and Future Probl. in High Temp. Chem., Houston, Tex.
(Contract W-7405-ENG-26)
(LA-DC-7703; CONF-660106-1)

Various concepts proposed for nuclear propulsion and related problems in high-temperature chemistry are discussed. These include: rocket engines; heat exchanger reactors; use of nuclear reactors for production of electrical power; and chemical rocket engines. NSA

N66-30997# Atomic Energy Commission, New York.
GAMMA SPECTROMETRIC MEASUREMENT OF ^{235}U IN 24-IN.×24-IN.×12-IN. ABSOLUTE AIR FILTERS AND ASSOCIATED ECONOMICS OF URANIUM RECOVERY
Alan Fishman, Ira Cohen, and Frances K. Durkan 15 Dec. 1965 27 p refs
(NYO-10740) CFSTI: HC $2.00/MF $0.50

A non-destructive, gamma spectrometric procedure is described to determine the ^{235}U contained in 24×24×12 in. absolute air filters. Data obtained at two nuclear facilities using the technique are discussed. Either a prepared standard filter or a small number of filters from a contaminated filter inventory can be used to assign ^{235}U values to an entire filter inventory. Statistical tests comparing ^{235}U determined by gamma spectrometry against chemical analyses showed no significant difference. A computational method is presented, utilizing a digital computer, which provides a method for determining the number of filters that can be sent for uranium recovery to yield the greatest economic advantage. Author (NSA)

N66-31007# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
TECHNIQUE FOR MEASURING THE SPECTRUM OF INTERMEDIATE NUETRONS [TECHNICHE DI MISURA DELLO SPETTRO DEI NEUTRONI INTERMEDI]
G. Pauli Dec. 1965 19 p refs In ITALIAN
(RT-FI(65)57)

Some methods for determining the slowing-down spectra in a reactor from the activation of resonance detectors are examined and a few examples are reported. Author (NSA)

N66-31034# Societe Belge pour l'Industrie Nucleaire, Brussels.
USE OF PLUTONIUM AS A FUEL IN NUCLEAR REACTORS Quarterly Report No. 7, 1 Jul.-31 Dec. 1965
Dec. 1965 79 p refs
(Contract EURATOM-001-64-1 TRUB)
(EURAEC-1552; EUR-2694; BN-6512-02) CFSTI: HC $3.00/MF $0.75

An attempt was made to correlate the homogeneity of the plutonium in vibratory-compacted fuel elements with the powder characteristics and method of loading. Calculations and measurements were made of the effects of irradiation and plutonium heterogeneity on the neutron flux distribution along the length of fuel elements. Fuel elements were evaluated during irradiation as to the temperature distribution and its dependence on the power released by the fuel and the heat transfer properties of the cladding geometry. The neutron physics study of the 15.4 and 22 mm pitch UO_2–PuO_2–H_2O lattices performed on the Thetis lattice was completed. A critical approximation with cylindrical and square geometries, and a variable poisoning measurement were made for these two lattices. Pulsed and source ejection measuring methods were used and gave similar results. The slope and linearity for the function $\alpha=f$ (number of rods) made it easy to estimate the prompt critical mass. NSA

N66-31045# Ceskoslovenska Akademie Ved, Rez. Ustav Jaderneho Vyzkumu.
RADIATION RESISTANCE OF $NaNO_2$ SOLUTION USED TO INHIBIT CORROSION OF STEEL IN WATER [RADIACNI ODOLNOST ROZTOKU DUSITANU SODNEHO JAKO INHIBITORU VODNI KOROZE OCELI]
V. Zajic and V. Rypar 1965 26 p refs In CZECHOSLOVAKIAN
(UJV-1453/65)

The radiation resistance of aqueous sodium nitrite, used to inhibit the corrosion of steel in solution, was studied in the VVR-S research reactor. After 50 hr in the reactor the sodium nitrite concentration of the solution decreased to a constant level and remained at that level for another one-hundred hours. The constant level depended on the initial concentration, but was always sufficient to inhibit corrosion (i.e., greater than 1 g/liter) when the initial concentration was greater than 7 g/liter. In some cases there was a slight regeneration of nitrite, with the $NaNO_2$ concentration rising slightly after reaching a minimum value. For the VVR-S fluxes the radiation intensity had little effect on the results. The volume of the solution likewise was not significant. The nature of the gas phase affected the results somewhat, with hydrogen and oxygen being better than nitrogen in protecting the sodium nitrite from the irradiation. NSA

N66-31055# Du Pont de Nemours (E. I.) and Co., Aiken, S. C. Savannah River Plant.
REACTOR ON-LINE COMPUTER
W. B. Wilmer, J. D. Bickley, R. V. Studly, W. M. Taylor, and J. J. Thompson Mar. 1966 27 p refs Presented at Instr. Soc. of Am., Southeastern Conf. and Exhibit, Augusta, Ga., 19–21 Apr. 1966
(Contract AT(07-1)-1)
(DPSPU-66-30-6; CONF-660408-3) CFSTI: HC $2.00/MF $0.50

A prototype system that is used to improve the operating safety and efficiency of a large production reactor at the Savannah River Plant is described. The on-line computer receives information from about 3300 sensors that monitor the reactor and cooling systems and provides the reactor operations with data for adjusting the axial and radial power distributions. NSA

N66-31060# General Electric Co., San Jose, Calif. Atomic Power Equipment Dept.
HIGH PERFORMANCE UO_2 PROGRAM Quarterly Progress Report No. 18, Jul.-Sep. 1965
M. F. Lyons, ed. 1 Nov. 1965 60 p refs
(Contract AT(04-3)-189)
(GEAP-3771-18) CFSTI: HC $3.00/MF $0.50

A metallic ingot located at the bottom of a UO_2 fuel collum was removed from the surrounding fuel. The ingot

density was found to be high (11.3 gm/cm^3) and the electrical resistance nearly zero, providing proof of the metallic character of the ingot. After separating out Ru, the remaining major isotopic activity was ^{125}Sb, a relatively low-yield fission product. Chemical tests showed that Mo was a major constituent of the ingot, while U and Pu were nearly absent. Analysis of limited data on hyperstoichiometric UO_2 indicates that the thermal conductivity was not significantly different from that measured for stoichiometric material. Postirradiation examination of a thermal conductivity capsule revealed several potential explanations for an electrical short. The temperature sensor was disassembled, rebuilt incorporating design changes to avoid these electrical weak spots, and recalibrated. The third isothermal fission gas release capsule IFFGE No. 3 was irradiated with the isothermal sample operating steady state at 1900°C. The capsule performance was flawless during irradiation, but postirradiation examination showed the sample W cladding had leaked. The fission gas analysis for IFFGE No. 1 was completed. The release fraction is 0.8% based on all of the fuel in the capsule, i.e., both isothermal sample and heater-insulator fuel. Analyses are underway to refine the release value and determine the fraction attributable to the isothermal fuel sample. Postirradiation strength properties determined on tensile coupons were analyzed and correlated with the corresponding pre-irradiation values. Results are reported for Zircaloy-2, Incoloy, and Inconel after irradiation at 350°F to 1.2×10^{21} and 2.4×10^{21} nvt (E>1 Mev), and testing at room temperature, 600, and 1100°F. The reaction of I with unautoclaved Zircaloy-2 foil is uniform, linear, and varies with the I pressure, raised to the 0.4 power. The temperature dependence was erratic. The reaction with autoclaved Zircaloy-2 is nonuniform with severe pitting, demonstrating the importance of the oxide film. A single irradiated cladding sample had a shorter induction period, but a slower reaction rate than the unirradiated monitor sample at the same temperature. At the I concentration in these experiments, which is comparable to the stable I inventory in an operating fuel rod, the reaction rate is sufficiently rapid to penetrate a typical cladding thickness in a few hr. The fact that this reaction does not occur indicates the I within an operating fuel rod is probably not free, but bound to some other element. The fission product and Pu distribution data from high performances UO_2 fuel rods were analyzed and correlated. These rods operated with intermediate and incipient central melting. No evidence of axial Cs migration was observed in the rod operated with incipient central melting, which suggests the axial migration of the volatile fission products is a direct consequence of melting. The axial fission product distributions corresponded to the integrated average neutron flux profile during irradiation. The rod operated with intermediate central melting showed evidence of convective mixing and homogenization of fission product concentrations with the molten core. Superimposed on the convective mixing there appears to be a radial segregation effect within the molten zone for Pu and Cs. This segregation is hypothesized to be from rejection of impurities from the UO_2 as it recrystallizes. NSA

N66-31072# Westinghouse Electric Corp., Pittsburgh, Pa. Atomic Power Div.

BIAXIAL STRAIN FATIGUE OF ZIRCALOY-4. PART B: ANALYSIS OF TEST RESULTS, DEVELOPMENT OF STRAIN FATIGUE MODEL, AND APPLICATION TO DESIGN

R. E. Schreiber Oct. 1965 136 p refs
(Contract AT(30-1)-3269)
(WCAP-2269-42 B) CFSTI: HC $4.00/MF $1.00

Biaxial strain fatigue data are reported for 10–15% cold worked Zircaloy-4 tested at 715°F. Push–pull cyclic buckling tests were also performed. A mathematical model of strain fatigue was developed and applied to a design problem involving fuel rod cladding for the San Onofre Reactor. The predicted fraction of fatigue life consumed was 30%. Author (NSA)

N66-31073*# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.

PREPARATION OF MICROSCOPIC CROSS SECTIONS OF U_{238} FOR REACTOR CALCULATIONS

Donald W. Drawbaugh, Gordon Gibson, and M. M. Melnick 28 Feb. 1966 41 p refs Presented at Am. Phys. Soc. Conf. of Neutron Cross Section Technol., Washington, 22–24 Mar. 1966
(Contract SNP-1)
(NASA-CR-76434; WANL-TME-1384; CONF-660303-13) CFSTI: HC $2.00/MF $0.50 CSCL 18J

A set of resonance parameters for the epithermal range is given. The origin of these parameters is described. Of importance for reactor calculations is a table which gives the smooth (temperature independent) background cross sections which must be added in order to bring the single-level theoretical cross sections into agreement with experiment. The Saclay experimental data were used; the corresponding Doppler broadening and experimental resolution were taken into account in the calculations. This representation for the cross sections is of value for calculations concerning nuclear rocket reactors (NERVA) which operate at high temperatures, and for which a large fraction of the fissions are induced by epithermal neutrons. Author (NSA)

N66-31075# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

CROSS SECTION SENSITIVITY CALCULATIONS FOR SMALL HYDROGEN MODERATED SYSTEMS

S. Weinstein, F. Feiner, K. V. Cooper, and S. I. Armstrong 22 Mar. 1966 17 p Presented at Am. Phys. Soc. Conf. of Neutron Cross Section Technol., Washington, D. C., 22–24 Mar. 1966
(Contract W-31-109-ENG-52)
(CONF-660303-6) CFSTI: HC $1.00/MF $0.50

Experiments were performed with the KAPL Solid Homogeneous Assembly. The cores built on the assembly are leakage dominated and were designed to have an enhanced sensitivity to high energy cross sections. Sensitivity calculations were made using evaluated microscopic cross sections for oxygen, zirconium, carbon, and uranium-235. NSA

N66-31076# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.

PASSAGE OF NEUTRONS WITH ENERGY $E_0 \leq 30$ MeV IN ORDINARY CEMENT AND IN ITS COMPONENTS [PASSAGIO DI NEUTRONI DI ENERGIA $E_0 \leq 30$ MeV IN CEMENTO ORDINARIO E NEI SUOI COMPONENTI]

M. A. Locci, P. Picchi, and G. Verri 16 Feb. 1966 24 p refs In ITALIAN /*ts* Note No. 307
(LNF-66/7)

The absorption of neutrons with initial energy $E_0 \leq 30$ Mev in ordinary cement (a mixture of the following elements: H, C, O, Na, Mg, Al, Si, K, Ca, and Fe) was studied. Each of the individual components was considered as an absorber. The calculation was programmed in FORTRAN IV and the physical data and the calculation method used are reported. The results are graphed. Author (NSA)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N66-31085# Geoscience, Ltd., Solana Beach, Calif.
HIGH ACCELERATION FIELD HEAT TRANSFER FOR AUXILIARY SPACE NUCLEAR POWER SYSTEMS
H. F. Poppendiek, N. D. Greene, C. M. Sabin, L. V. Feigenbutz, G. Mouritzen et al Jan. 1966 125 p refs
(Contract AT(04-3)-409)
(SAN-409-29; GLR-42) CFSTI: HC $4.00/MF $0.75

The principal results of analytical and experimental work directed toward the study of the mechanisms which control boiling heat transfer, both in linear and helical forced flow boiling, are presented. The analytical results presented consist of studies of idealized momentum and heat transfer models. The particular phase distributions studied are representative of linear and helical flow systems. In experimental work, emphasis was placed on high acceleration field helical flow boiling, with mercury and potassium as the working fluids. The majority of the forced convection experiments were performed under nearly uniform wall heat flux boundary conditions. The results were divided into two main categories, momentum and heat transfer. The analytical work was further classified on the basis of simplified types of phase distributions. NSA

N66-31093# Ohio State Univ. Research Foundation, Columbus.
INVESTIGATION OF CRACKING IN STAINLESS STEEL FUEL ELEMENTS, DECEMBER 1964–AUGUST 1965
R. W. Staehle 25 Oct. 1965 82 p refs
(Contract AT(11-1)-1319)
(COO-1319-30) CFSTI: HC $3.00/MF $0.75

An investigation was undertaken to elucidate the nature of a cracking mechanism whereby a number of stainless steel clad fuel elements failed in experimental assemblies in the VBWR. The experimental investigation included optical metallography, microhardness, Huey tests, anodic polarization, chemical analysis, and electron microscope fractography. An attempt was made to rationalize observations on the basis of a cracking mechanism which was either entirely mechanical or chemical–mechanical. Such an approach was desirable in order to assess whether the cracking was applicable only to the specific experiment or to a broad range of reactor types and materials. Because of the lack of critical information, no definite conclusion regarding either mechanism was obtained. While the evidence available at this time seems to favor a chemical–mechanical or stress corrosion cracking type of mechanism, it is believed that a sufficiently good case exists for the mechanical idea that it cannot be discounted. Recommendations are given regarding specific experiments which should be performed to reach a credible conclusion.
Author (NSA)

N66-31349*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PROGRAM FOR CALCULATION OF NEUTRON AGES FROM EXPERIMENTAL ACTIVATION DATA
Thor T. Semler Washington, NASA, Jul. 1966 33 p refs
(NASA-TM-X-1260) CFSTI: HC $2.00/MF $0.50 CSCL 18K

A program for the computation of neutron ages from experimental activation data is described. The quadrature schemes and error analyses are detailed along with some curve-fitting techniques. A best-fit derived from statistical decision theory is described. Author

N66-29986*# Army Missile Command, Huntsville, Ala.
ON THE FREQUENCY OF RETURNING ACOUSTIC RAYS AND FOCUSING FOR HUNTSVILLE AND MISSISSIPPI TEST FACILITY
Oskar M. Essenwanger 21 Jan. 1966 55 p refs
(NASA-Order H-61485)
(NASA-CR-76125; RR-TR-66-2; AD-632607) CFSTI: HC $3.00/MF $0.50 CSCL 20A

The problem of acoustic focusing by returning sound-rays from the atmosphere in the Huntsville and Mississippi test facility is analyzed in this report. First, an objective criterion to determine focusing by computer methods from the atmospheric data and the derived sound speed profile is presented. Afterwards, the empirical probability of focusing is derived for four seasons for the event of a test firing, as a function of the azimuth and with its areal distribution. In short, returning rays in the afternoon hours can be expected in 25 percent of the firings in summer and 90 percent in winter; however, focusing chances are 10 percent in summer and 50 percent in winter. The azimuthal variation ranges from around 60 percent for easterly to 5 percent for westerly directions in wintertime and reduces to 10 to 1 percent, respectively, in summer. Average chances for focusing encountered by isolated targets of limited areal extent may be as high as 20 percent in wintertime, while they stay below 5 percent in summer. The wind influence is considerably higher than commonly assumed. Practically all focusing in summer can be attributed to the superposition of the wind profile upon the temperature profile. Only 10 to 15 percent of focusing in the winter afternoon hours is caused by the structure of the temperature profile (inversions).
Author (TAB)

N66-29998# Liege Univ. (Belgium). Dept. of Astrophysics.
DEVELOPMENT OF A HEATED GRAPHITE HOLLOW-CATHODE DISCHARGE TUBE FOR THE STUDY OF MOLECULAR SPECTRA Technical Note No. 11
Francois Remy 20 Dec. 1965 17 p refs
(Contract AF 61(052)-587)
(AFCRL-66-220; AD-632129) CFSTI: HC $1.60/MF $0.50

The first part of this report points out the principal references giving this way a survey of the numerous fields of application of the hollow-cathode discharge. The second part is devoted to the description of a hollow-cathode discharge the cathode of which is a heated graphite furnace. This installation was developed with the aim of bringing some contribution to the knowledge of carbonaceous molecules of special interest for astrophysics. Author (TAB)

N66-30014# Stanford Univ., Calif. High Energy Physics Lab.
STANDING WAVE MODES IN A SUPERCONDUCTING LINEAR ACCELERATOR
Todd I. Smith Apr. 1966 35 p refs
(Contract Nonr-225(67))
(HEPL-437; AD-632510) CFSTI: HC $2.00/MF $0.50

In connection with the work on the superconducting linear accelerator, various accelerator structures have been considered. Because of its simplicity a standing wave structure is extremely attractive. Accordingly, this paper is devoted to an

understanding of standing wave linacs. Although the results are applicable to conventional as well as to superconducting structures, the problems studied and the sample calculations given are appropriate for superconducting structures.
Author (TAB)

N66-30067# Joint Publications Research Service, Washington, D. C.
OPTICAL INSTRUMENTS: CALCULATING THE RANGE OF LONG-RANGE OPTICAL SYSTEMS WITH RETURN REFLECTORS CONSISTING OF A SET OF PYRIMIDAL PRISMS
Yu. M. Kutev and A. I. Sadykova *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 139–144 refs (See N66-30046 17-10) CFSTI: $5.00

General expressions are obtained associating the limit range of a long-range optical system with return reflectors consisting of a set of pyrimidal prisms with the parameters of the system and the return reflector. It is shown that for limit ranges of the order of 50 or more km, the main parameter affecting the range of the long-range system is light scattering from the return reflector which is determined by the deviation of its dihedral angles from a straight angle. Author

N66-30086# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
JOURNAL OF APPLIED MECHANICS AND TECHNICAL PHYSICS Collection of Articles
14 Sep. 1965 351 p refs Transl. into ENGLISH of Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 2, Mar.–Apr. 1964 p 1–176
(FTD-MT-64-285; AD-623009)

A selection of articles on various topics related to applied mechanics and technical physics is presented. For individual titles see N66-30087–N66-30114.

N66-30087# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLUTION OF THE PIERCE PROBLEM FOR A RIBBON BEAM UNDER ARBITRARY EMISSION CONDITIONS
V. A. Syrovov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 1–9 refs (See N66-30086 17-23)

Focusing electrodes are determined for a ribbon beam of analogously charged particles under arbitrary conditions in the emitter. It is shown that a continuous dependence of angle of inclination of zero equipotentials on initial speed and field is absent. Obtaining the solution of equations of beam comprise only part of the problem. For the realization of the flow being described by such a solution, it is necessary to consider the question on the system of focusing electrodes to assure the existence of a beam of a given configuration. The solution of this question reduces to the problem on analytic continuation of potential given at the boundary of the beam together with its own normal derivative into a region free of charges, i.e., to the Cauchy problem for the Laplace equation.
Author

N66-30099# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON DETERMINING CALIBRATION CURVES OF VERY HIGH PRESSURE INSTALLATIONS
D. S. Mirinskiy *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 195–208 refs (See N66-30086 17-23)

A general scheme is developed for calculating calibration curves of two-punch pressure apparatuses of the Bridgman anvils type. The principle of self-packing of an elasto-plastic medium, being utilized in two and multipunch apparatuses of very high pressure, is examined. For pressures up to 100,000 atm the problem of stress distribution in a self-packing washer compressed between two elastic plane-parallel plates is considered. Flow regions on the contact surface are outlined, and differential equations are developed. Results of the calibration are compared with reference points of bismuth, thallium, and barium from Bridgman's data. The possibility of using the method for calculating calibration curves of multipunch apparatuses such as the clamp, tetrahedral, and cubic pressure boosters is considered.
S.P.

N66-30101# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUALITATIVE INVESTIGATION OF DIFFERENTIAL EQUATIONS OF A FLIGHT BY MEANS OF SOLAR SAIL
K. G. Valeyev *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 223–243 refs (See N66-30086 17-23)

Previous investigations of flight by solar sail are reviewed and inaccuracies in the calculations of differential equations are pointed out. The possibilities of using solar sails during space flights are discussed, and special attention is given to the case in which thrust constitutes constant angle with the direction of sun rays, or is directed along the velocity. Equations are formulated to solve certain problems on the selection of optimum inclination angle of the sail. Motions along a parabolic orbit and a logarithmic spiral are compared. L.E.W.

N66-30116*# TRW Systems, Redondo Beach, Calif.
DEVELOPMENT AND FABRICATION OF ABLATIVE OPTICAL BEACONS Final Report, 4 Dec. 1965–30 Apr. 1966
F. N. Mastrup and R. Odenberg 17 May 1966 47 p *ref*
(Contract NAS9-5374)
(NASA-CR-65413; TRW-5541-6001-R-000) CFSTI: HC $2.00/MF $0.50 CSCL 20F

The life, reliability, and spectrum of radiation of an ablative flash lamp is discussed, with particular emphasis on its performance in the space environment and suitability for the Apollo command service module. Two lamp designs are described, and the ablative lamp is shown to be superior to xenon lamps, especially when high Joule applications are required. The superiority of the ablative lamp was demonstrated by the facts that no degradation of light output resulted with operating life and the light intensity of each flash was nearly exactly the same. The pulsed-ablator and boiler trigger systems are examined, and the test program for the selected boiler design is listed. Quartz proved to be an excellent ablator for the boiler ablative lamp with advantages in thermal capability and in inherent transmission of ultraviolet light; however, the ablation rate was found to be dependent on the quality of the quartz. Mechanical designs of an anode that would eliminate failure modes are discussed.
S.P.

N66-30146# Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS
William M. Leak, ed. Mar. 1966 57 p refs
(PB-169444) CFSTI: $1.25

CONTENTS:

1. SUBMARINE TOPSIDE COATINGS FOR APPLICATION IN COLD, DAMP WEATHER D. E. Field p 1–8 refs

2. THE NRL SOZOTRON PROJECT D. C. de Packh p 9–20 refs (See N66-30147 17-25)
3. CHEMISTRY C. M. Murphy et al p 21–22
4. MECHANICS A. M. Sullivan p 22–24 refs
5. METALLURGY AND CERAMICS C. N. Freed et al p 24–42 refs
6. NUCLEAR AND ATOMIC PHYSICS I. Manning et al p 42–44 refs
7. OPTICAL PHYSICS L. S. Birks et al p 44–45
8. RADIO R. S. Lee et al p 45–46 refs
9. SOUND M. Plato and R. Curtis p 46–48 refs

N66-30154# Southwest Research Inst., San Antonio, Tex.
PARAMETRIC COUPLING IN A NONLINEAR ELECTRO-MECHANICAL SYSTEM, PART II Final Report
Daniel D. Kana 15 May 1966 49 p refs

Parametric coupling that arises under certain conditions of excitation was analyzed in an electrical RLC circuit that is coupled with a mechanical system through a nonlinear inductance. It was found that high frequency excitation of the electrical circuit can support low frequency oscillations of the mechanical system, the entire process arising through the existence of a low order instability in the coupled system. Approximate methods of analysis were used to show the existence of the instability as well as the form of subsequent motion and were compared with analog computer results. The behavior of the electromechanical system was found to be analogous to a similar coupling that can occur between lateral wall vibrations and surface oscillations of liquid in a partially filled elastic cylinder. Author

N66-30157# Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS Quarterly Report, Oct.–Dec. 1965
1 Mar. 1966 52 p refs
(NAVWEPS-8847; AD-630653) CFSTI: HC $4.60/MF $0.50

CONTENTS:

1. MAGNETO-OPTICAL OBSERVATIONS WITH A TEN-MILLIWATT HELIUM–NEON LASER J. L. Tomlinson p 1–3 refs (See N66-30158 17-16)
2. IMPROVED SYSTEM FOR OBSERVATION OF HIGH-SPEED MAGNETIZATION REVERSAL G. H. Moore p 4–10 refs (See N66-30159 17-23)
3. INFRARED ABSORPTION OF Ce^{3+} IN LaF_3 AND OF CeF_3 R. A. Buchanan, H. E. Rast, and H. H. Caspers p 11–20 refs (See N66-30160 17-26)
4. SYNTHESIS STUDY OF A CONTINUOUS-SOURCE WAVEGUIDE ANTENNA A. P. Boblett p 21–38 (See N66-30161 17-07)

N66-30159# Naval Ordnance Lab., Corona, Calif.
IMPROVED SYSTEM FOR OBSERVATION OF HIGH-SPEED MAGNETIZATION REVERSAL
G. H. Moore *In its* Foundational Res. Proj. 1 Mar. 1966 p 4–10 refs (See N66-30157 17-23) CFSTI: HC $4.60/MF $0.50

A previously designed system for the direct observation of high speed magnetization reversal in films is described and its limitations are discussed. Two methods are suggested for obtaining shorter light pulses and thus improving the system. One method is by the use of four contrarotating prism mirrors and the other by the use of the Miller principle used in very high speed cameras. Author

N66-30187*# TRW Systems Group, Redondo Beach, Calif.
THEORETICAL INVESTIGATION: THE SCATTERING OF LIGHT BY A PLANETARY ATMOSPHERE Final Report, 15 Sep. 1965–21 Jun. 1966
Robert S. Fraser [1966] 119 p refs
(Contract NAS5-9678)
(NASA-CR-76122; TRW-4520-6003-R000) CFSTI: HC $4.00/MF $0.75 CSCL 20F

Computed effects of specular reflection at the ground on the radiation scattered from a Rayleigh atmosphere are presented. The relative contribution to the ground albedo by each of several components of the radiation field is discussed. The characteristics of the neutral points in the degree of polarization that would be observed from the ground looking up or from above the atmosphere looking down are presented. Author

N66-30213# IIT Research Inst., Chicago, Ill.
F AGGERATE CENTERS IN SODIUM FLUORIDE
Karl Konrad (M.S. Thesis) Jan. 1966 57 p refs
(Contract AT(11-1)-1044)
(COO-1044-23) CFSTI: HC $3.00/MF $0.50

Extensive, low temperature x irradiation of monocrystalline NaF resulted in the formation of high color center densities. Warming from the temperature of x irradiation (either 80 or 200° K) caused thermal bleaching of the large F' band which peaks at ca 470 mμ. Thermally induced formation of M centers was observed. The extent of aggregation was not great, and letting the crystal equilibrate in the dark at room temperature did not further enhance the concentration of F aggregate centers as it does in other alkali halides. Optical F band bleaching resulted in the formation of large concentrations of F aggregate centers, typically, $OD_{M_1} > OD_F$. Color centers in x irradiated, natural (Villiaumite) and synthetic NaF were studied via diffuse reflectance spectra. X irradiation of Villiaumite resulted in color center absorptions at wavelength positions expected for NaF. X irradiation of synthetic NaF resulted in prominent F and M_1 bands (F at 345 mμ and M_1 at 505 mμ). Optical F band bleaching caused the appearance of a peak at 305 mμ, which was also observed when x irradiated monocrystalline NaF was bleached with F band light. R_2 band bleaching caused a decrease in the R_2 band and increased in the F and M_1 bands. The results support the van Doorn and Haven F_3 model of the R center. Author (NSA)

N66-30217# IIT Research Inst., Chicago, Ill.
MAGNETIC PROPERTIES OF INSULATORS Quarterly Report, 15 Aug.–15 Nov. 1965
Gordon A. Noble 5 Dec. 1965 49 p refs
(Contract AT(11-1)-587)
(IITRI-U6028-19; COO-587-19) CFSTI: HC $2.00/MF $0.50

The width, shape and relative areas of optical absorption bands associated with color canters show some changes as the concentration rises from 10^{16} to 10^{17} cm^{-3}. Reflection spectra can provide optical data at concentrations from 10^{16} to 10^{19} cm^{-3}. Measurements were made of the normal specular reflection using a modification of the spectrophotometer used for absorption. The difference between the reflection coefficients of the colored and uncolored crystals shows color center reflection bands. Irradiation of KCl with gamma rays at room temperature produces reflection bands in the F and V regions. Additive coloration produces F, M, N, L type bands. The reflection bands are generally less well resolved than the absorption bands. At

higher concentrations some sharp peaks are observable in the R, M, N spectral region. At very low concentrations in samples showing only F bands, the ratio of the real to the imaginary part of the index of refraction is several thousand. The experimental results are qualitatively consistent with a simple model. Author (NSA)

N66-30328*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SPECTRAL DISTRIBUTION AND UNIFORMITY OF THE CARBON ARC

Steve Alexander Mar. 1966 54 p ref

(NASA-TM-X-55505; X-713-66-79) CFSTI: HC $3.00/MF $0.50 CSCL 20F

The uniformity and spectral irradiance of a Genarco ME4CWM carbon arc have been determined. The uniformity using a one element lens system was ±14% over a 12 inch target area. The spectral irradiance of the bare arc is a fairly good match to the air mass zero solar irradiance. The arc has an excess of energy between 380 nm and 400 nm and from 1000 nm to 2600 nm and a deficiency of energy between 400 nm and 800 nm. Author

N66-30333*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EXPERIMENT ON PENDULUM MOTION OF A BALLOON GONDOLA

Guenter R. Riegler Mar. 1966 12 p

(NASA-TM-X-55510; X-611-66-111) CFSTI: HC $1.00/MF $0.50 CSCL 04A

A camera on board a balloon gondola was aimed at the horizon in order to monitor the attitude of the gondola. An analysis of the film, which was exposed during one flight, provides evidence that no pendulum motion had occurred during the flight with amplitude larger than 0.5 degrees. This analysis, however, did indicate the presence of a significant rotational motion of the gondola, without apparent regularity as to speed and sense of rotation. Author

N66-30426# Deutsche Versuchsanstalt für Luft- und Raumfahrt, Stuttgart (West Germany). Institut für Spektroskopie und Molekularstrahltechnik.

AN EXTENSION OF THE SWAN SYSTEM AND THE ANALYSIS OF THE HIGH PRESSURE BANDS OF THE C_2 MOLECULE [EINE ERWEITERUNG DES SWAN-SYSTEMS UND DIE ANALYSE DER HOCHDRUCK-BANDEN DES C_2-MOLEKUELS]

Gerd Messerle May 1966 36 p refs In GERMAN; ENGLISH summary

(DVL-509; DLR-FB-66-31) CFSTI: HC $2.00/MF $0.50

The Swan system ($A^3\Pi_g$–$X'^3\Pi_u$) of the C_2 molecule was investigated by spectroscopic means. In this connection the unknown vibrational levels 4, 5 (High pressure bands) 11 and 12 of the $A^3\Pi_g$ term and $\Delta G_{7,8}$ and $\Delta G_{8,9}$ of the $X'^3\Pi_u$ terms were determined. The levels 1, 2, and 3 of the $A^3\Pi_g$ terms and the levels 1, 2, 3, 4, and 5 of the $X'^3\Pi_u$ term were determined more exactly. A previously unknown band was analyzed which proved to be the (3-3) band of the Swan system. From all the available material improved molecular constants for the two electronic states $A^3\Pi_g$ and $X'^3\Pi_u$ of the C_2 molecule were obtained. Author

N66-30494# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.

REMARK ON PROTON SPIN-LATTICE RELAXATION IN LIQUID HYDROGEN SULPHIDE [UWAGI O SPINOWO–SIECIOWEJ RELAKSACJI PROTONOW W CIEKLYM SIARKOWODORZE]

Jacek W. Hennel Jan. 1966 12 p refs Submitted for Publication

(Rept.-445/PL) CFSTI: HC $1.00/MF $0.50

It is shown using the theory of Hubbard that the temperature dependence of spin-lattice relaxation time in liquid H_2S can be accounted for by spin-rotational and dipolar interaction. Author

N66-30666# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.

A CRYOFURNACE FOR MOSSBAUER SPECTROSCOPY

B. Sharon and D. Treves 1 Aug. 1965 15 p refs

(Contract AF 61(052)-654)

(TN-17; AD-632751) CFSTI: HC $1.00/MF $0.50

A vacuum cryofurnace for Mossbauer effect studies permitting temperature control from 85°K to 870°K is described. Any temperature in this range can be maintained for long periods, utilizing an appropriate electronic temperature stabilizer. Temperature inhomogeneity over the sample is estimated to be less than 1°K. This cryostat can transmit radiation with a conical angle of 12. The operation of the cryofurnace is simple and samples can be quickly interchanged. Author

N66-30726# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

POLARIMETRY SIGNATURE OF TERRESTRIAL AND PLANETARY MATERIALS

W. G. Egan and H. B. Hallock Apr. 1966 24 p refs Presented at 4th Symp. on Remote Sensing of Environ., Michigan Univ., Ann Arbor, 13 Apr. 1966

(RM-322J; AD-481714)

Characteristic features of the per cent polarization curve and the location of the plane of polarization as a function of phase and viewing angles are significant. These are the maximum and minimum per cent polarization, the phase angles where these occur, the inversion angle, the ratio of maximum to minimum polarization and the rate of rise of polarization with phase angle. These properties as a function of the spectral range serve to characterize in detail any terrestrial surface. Data are presented to indicate the diversity of polarimetric signatures that are obtained on some materials. The data were obtained, in part, on a large scale spectral polarimeter, which permits observations to be made in the visible and infrared. TAB

N66-30759*# Syracuse Univ. Research Inst., N. Y. Dept. of Mechanical and Aerospace Engineering.

NOISE INVESTIGATIONS WITH IMPINGING JET FLOWS Status Report No. 6, 1 Dec. 1965–31 May 1966

Darshan S. Dosanth and Francis J. Montegani Jun. 1966 36 p refs

(Grant NsG-431)

(NASA-CR-76316; ME-1085-660606) CFSTI: HC $2.00/MF $0.50 CSCL 20A

Further investigations of the far field noise radiation from an under-expanded convergent axisymmetric main jet flow were conducted in an anechoic chamber. The main jet flow was normally operated at a total pressure of 100 psig, and

percent impingement was varied from 0% to 50%. Experimental data recorded from the main jet flow alone and the interacting jet flows yielded total acoustic power radiated, directional patterns, and 1/3 octave band power spectra. At low values of percent impingement, the total acoustic power radiated increased; between 0% and 33% impingement, the power radiated decreased to a relative minimum; and at still higher values of percent impingement, the power radiated increased again. The corresponding flow characteristics at different values of percent impingement were recorded by shadowgraphs, which permitted determination of flow behavior including geometry of the shock structure and identification of strong acoustic sources in the flow. A possible relation between total acoustic power radiated and observed acoustic sources and changes in shock geometry and flow structure is examined. L.E.W.

N66-30793*# Wyle Labs., Inc., Huntsville, Ala.
NOISE FIELD FOR SHADOWGRAPH MODEL ROCKET EXPERIMENTS
R. C. Potter Jun. 1966 17 p
(Contract NAS8-11312)
(NASA-CR-76267; TM-66-18) CFSTI: HC $1.00/MF $0.50 CSCL 20A

Sound field measurements of a hot model rocket flow are required as part of a study being conducted on Mach wave radiation from supersonic rocket exhausts. To make these measurements, a series of microphones will first be placed in the roof of a shadowgraph tent and the sound pressure levels recorded. Later, the microphones will be placed near the jet flow and an attempt will be made to correlate individual Mach waves with their shadowgraphs. Calculations are made to estimate the overall levels and spectra at each of the various microphone positions. The overall sound power generated by the model rocket exhaust is determined, and the sound radiated to each point is found. The calculations are only approximate, especially for the nearest microphone position, but will allow the order of the sound levels to be obtained. The calculated levels may be slightly low and therefore, it is recommended that microphone with a range of 120 to 150 dB, re: 0.0002 dyne/cm^2 be used for the measurements, in particular Bruel and Kjaer 0.25-in condenser microphones which have a good response range and are small and compact. R.N.A.

N66-30879# Centre National de Recherches de l'Espace Brussels (Belgium).
INTRODUCTION TO CHEMICAL AERONOMY
Marcel Nicolet Mar. 1964 47 p refs Presented at meeting of Faraday Soc., Edinburgh, 2-3 Apr. 1964 *Its* Note Preliminaire No. 40
CFSTI: HC $2.00/MF $0.50

This is a study of the various photochemical equilibria relative to the main constituents of the atmosphere. After recalling that the atmosphere can be divided into 2 regions, the homosphere (where the composition of the principal constituents is constant) and the heterosphere (where the composition depends on oxygen dissociation and diffusion), the author considers in turn the major and the minor atmospheric constituents (O_2, N_2, CO_2, H_2O, O_3, N_2O, H_2, etc.), and studies how each of them absorbs solar radiation. Starting from an atmosphere consisting of pure oxygen, he calculates the departure from equilibrium conditions caused by introducing (a) hydrogen and its various compounds and (b) nitrogen and its compounds. B.D.

N66-30899# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).
RANDOM DISTRIBUTIONS OF COUNTS AND CORRELATIONS DUE TO MEASURING DEVICES [DISTRIBUZIONI CASUALI DI CONTEGGI E CORRELAZIONI INTRODOTTE DAGLI STRUMENTI DI MISURA]
N. Pacilio and T. Ferrari Sep. 1965 16 p refs In ITALIAN (RT/FI(65)34)

A theoretical and experimental analysis of random distributions is realized at an approach to the application of stochastic methods to the discrete ensembles of counting problems. A theory of the correlation due to non-ideal measurement devices is presented and some experimental comparisons are given. The method suggests a simple way to measure the instrumentation dead-time. It also allows a correct approach to the short-time-variance method (prompt neutron lifetime measurements in nuclear reactors.
Author (NSA)

N66-31024# Brown Univ., Providence, R. I. Dept. of Physics.
SURVEY AND CLASSIFICATION OF SOLUBLE FIELD THEORY MODELS
H. M. Fried [1965] 13 p Presented at the Am. Phys. Soc. Summer Meeting, New York, Jun. 1965
(Contract AT(30-1)-2262)
(NYO-2262-98; CONF-650653-6) CFSTI: HC $1.00/MF $0.50

A survey of the known soluble and semi-soluble models of quantum field theory is presented. By field theory one here means sets of coupled Green's functions, and the measure of solubility of a theory is just the degree to which these functions can be found. NSA

N66-31082# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
PRESENT STATE OF THE CONSTRUCTION TECHNIQUES OF SUPERCONDUCTING MAGNETS [STATO ATTUALE DELLE TECNICHE DI COSTRUZIONE DI MAGNETI SUPERCONDUTTORI]
G. Pasotti, N. Sacchetti, G. Sacerdot, and G. Sanna 11 Mar. 1966 14 p refs In ITALIAN *Its* Nota Interna 312
(LNF-66/13)

The present state of the techniques of constructing superconducting magnets is reviewed. The methods used for the preparation of magnet materials and the type of superconducting magnets constructed are discussed. The uses of superconducting magnets are briefly indicated. NSA

N66-31159*# Lehigh Univ., Bethlehem, Pa.
A PRELIMINARY STUDY OF HOLOGRAPHY
L. G. Mc Cracken, Jr. *In* NASA. Goddard Space Flight Center ASEE-Univ. of Md.-Catholic Univ. NASA Summer Fellowship Program Jan. 1966 p 77-88 refs (See N66-31154 17-07)
CFSTI: HC $4.00/MF $0.75

This is a preliminary study of holograms for information processing, attention being directed toward their formation, reconstruction of their images, and the images resolution. The formation of holograms is studied with respect to information preservation for two- and three-dimensional objects and resolution of the interference patterns controlled by frequency dispersion, beam collimation, and relative motions of the laser light source and objects to be imaged. Here, the emphasis has been placed on contrast and energy ratios; so that a suitable quantization measure can be determined. For reconstruction of the images from holograms, the problem of

"twinning" and its removal, multiple images spatially and/or frequency separated, and aperture limiting phenomena are explored. Finally, the image resolution upon reconstruction, manifesting the completeness of the hologram process, is found to depend on the previously discussed factors in such a way that additional study is required to obtain a meaningful measure. Author

N66-31205# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
THE KINETIC THEORY WITHOUT DIFFICULTY [LA THEORIE CINETIQUE SANS PEINE]
J. Ginibre May 1966 31 p refs In FRENCH
(TH/150) CFSTI: HC $2.00/MF $0.50

The algebraic structure of the kinetic theory is discussed in terms of its correlation function, and the Boltzmann, Liouville, kinetic, Bogoliubov, and other equations. Correlation functions of a system and the hierarchy of certain equations are presented, and a formal solution is given for the kinetic equation. Bogoliubov's point of view on the interaction representation is described and compared with the kinetic theory in its simplest form; a direct calculation of results is reported. Comments and equations are also included on the problem of irreversibility. Transl. by R.LI.

N66-31255# Brown Univ., Providence, R. I. Div. of Engineering.
MEASUREMENTS OF ATTENUATION AND DISPERSION OF SOUND BY AN AEROSOL Summary Report
Samuel Temkin and Richard A. Dobbins May 1966 41 p refs
(Contract Nonr-562(37))
(Nonr-562(37)/2; AD-632911) CFSTI: HC $2.00/MF $0.50

Attenuation and dispersion of sound by an aerosol, composed of oleic acid and a nitrogen carrier gas, were measured with an acoustic interferometer. Mean particle size and concentration were measured in situ by spectrophotometric tests. The measurements of attenuation and dispersion show good agreement with the theory in the range covered. In particular, the maximum attenuation per wavelength and the maximum dispersion, that are predicted by the theory, were confirmed experimentally. Author (TAB)

N66-31264# Lincoln Lab., Mass. Inst. of Tech., Lexington.
A NEW FORMULATION OF PARTICLE MECHANICS
Reese T. Prosser [1966] 60 p refs Memoirs of the Am. Mathematical Soc. No. 61
(Contract AF 19(628)-5167)
(JA-2278; ESD-TR-66-172; AD-632968) CFSTI: HC $3.00/MF $0.75

It is the purpose of this paper to provide an abstract formulation of the concept of a mechanical system containing both the classical and quantum formulations, and to derive its most elementary properties. Author (TAB)

N66-31375*# National Bureau of Standards, Boulder, Colo.
THE VISCOSITY AND THERMAL CONDUCTIVITY COEFFICIENTS OF DILUTE ARGON BETWEEN 100 AND 2000°K
H. J. M. Hanley 11 Mar. 1966 30 p refs
(NASA Order R-06-006-046)
(NASA-CR-76397; NBS-TN-333) GPO: HC $0.25; CFSTI: HF $0.50 CSCL 20M

The variation of the force constants of the Lennard-Jones, Exp: 6, and Kihara potential functions was investigated by comparing the Chapman-Enskog kinetic theory expression for the viscosity coefficient with the experimental viscosity of dilute argon. It was found that this variation was more pronounced than expected. It was necessary to rationalize the choice of the force constants of each function before using the function to compare theory with experimental data. Of the three, the Kihara was found to give the best correlation, and tables of the viscosity and thermal conductivity coefficients of dilute argon between 100 and 2000°K were computed from this potential and the Chapman-Enskog equations. Author

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N66-30017# American Meteorological Society, Boston, Mass.
METHOD OF FIELD-THEORETIC GREEN'S FUNCTIONS IN ATOMIC AND MOLECULAR PROBLEMS [METOD POLEVYKH FUNKTSII GRINA V ATOMNYKH I MOLEKULIARNYKH ZADACHAKH]
V. V. Tolmachev Bedford, Mass., AFCRL, Apr. 1966 37 p refs Transl. into ENGLISH from Sb. Litovskii Fiz. (USSR), v. 3(1/2), 1963 p 47-72
(Contract AF 19(628)-3880)
(T-R-546; TT-66-61220; AD-632414) CFSTI: HC $2.00/MF $0.50

The concepts and methods of the quantum field theory are applied to the many-electron problem in atoms and molecules. The field-theoretic formulation of perturbation theory is developed in these problems with respect to the smallness of the mutual interaction of the electrons and rules are given for composing the corresponding Feynman diagrams and the contributions from them. A comparison is made in the first and second orders between the field-theoretic and conventional forms of the perturbation theory. Two systems of exact field equations are formulated: one system of field equations, the Dyson-Schwinger, for study of the one-particle corpuscular aspect of the problem, and another, new system of field equations for study of the two-particle corpuscular aspect of the problem. Author

N66-30027# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.
THE HIGH ENERGY BEHAVIOR OF THE SCATTERING AMPLITUDE FOR NEGATIVE MOMENTUM TRANSFER
S. W. McDowell 1964 15 p refs Sponsored by NSF *Its* Notas de Fis., Vol. 11, No. 14
CFSTI: HC $1.00/MF $0.50

The high energy behavior of the scattering amplitude is investigated in the real negative region of momentum transfer $-t$, below the threshold $t=4m^2$ of the crossed channel. If one assumes the existence of bound states in the crossed t-channel with angular momenta larger than one, one can show that the high energy scattering amplitude behaves as if dominated by a Regge trajectory $\alpha(t)$ of even signature and the quantum numbers of the vacuum. It is shown that $\alpha(t)$ is continuous in the open interval $(0,4m2)$, and an upper bound for $\alpha(t)$ is given under the assumption of analyticity in the domain Re $\sqrt{t} \leq 2m$. Author

N66-30029# Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro.

APPARENT CP VIOLATION IN K_2^0 DECAY DUE TO A NEUTRAL VECTOR BOSON

Prem. P. Srivastava and Alberto Vidal 1964 12 p refs *Its* Notas de Fis., Vol. 11, No. 16

CFSTI: HC $1.00/MF $0.50

In the decay of K_2^0 in two pions, a suggestion has been made that the violation of CP invariance in weak interactions occurs. The CP violation can be avoided by introducing an isoscalar neutral vector boson s of very small mass, say of the order of the mass difference of K_2^0 and K_1^0 with strangeness zero. This boson is weakly coupled to strangeness currents only and the interaction conserves the strong selection rules. The coupling $K_2^0 K_1^0$ s turns out to be of the order of the square of the weak coupling constant which allows a speculation on the possible process $K_2 \rightarrow \nu + \bar{\nu} + \pi^+ + \pi^-$. R.N.A.

N66-30031# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

SOME REMARKS ABOUT COVARIANCE AND EQUAL TIME COMMUTATORS OF QUARK CURRENTS

L. P. Loubaton and G. Mennessier May 1966 16 p refs (TH/148) CFSTI: HC $1.00/MF $0.50

Sum rules are obtained by considering some kind of Compton amplitude expressed through reduction formula using the retarded commutator of two current components. A partial derivation yields two terms: the first is the product of a θ function by the commutator's derivative, and the second is the equal time commutator of current components. Evaluating this equal time commutator according to the quark model and some dispersive hypotheses lead to the desired sum rules. However, when considering the case of two space components, the result is not covariant. Since no convincing argument has been given to justify the choice of some privileged frame of reference, this appears like an inconsistency. This study examines where and how noncovariance creeps in, even though the calculation involves covariant quantities and covariant operations. It is shown that, in a quark model, splitting the derivative of the retarded commutator introduces an arbitrary time like unit vector. A discussion of the hypotheses needed to write down the sum rules shows that actually there is no contradiction. R.N.A.

N66-30042# Stanford Univ., Calif. High-Energy Physics Lab.

POSITIVE-PION PHOTOPRODUCTION AT 180° NEAR THE SECOND NUCLEON-PION RESONANCE

C. Schaerf Mar. 1966 16 p refs Submitted for Publication (Contract Nonr-225(67))

(HEPL-428; AD-632051) CFSTI: HC $1.00/MF $0.50

In a previous experiment the cross section for the photoproduction of pions in hydrogen near the second pion nucleon resonance was measured at 135 degrees and 180 degrees in the CMS. At 180 degrees the measurements did show a very sharp peak at a gamma ray energy of 700 MeV. The experiment has now been repeated only at 180 degrees, with improved energy resolution. The new results, in agreement with the old ones, show the same sharp energy dependence at about the same value of the primary energy. Author

N66-30216# Iowa State Univ. of Science and Technology, Ames.

ELECTRON CORRELATION, PAIR APPROXIMATION AND AUGMENTED PAIR EXPANSION. APPLICATION TO BERYLLIUM-LIKE ATOMIC SYSTEMS

Kenneth John Miller (Ph.D. Thesis) Feb. 1966 153 p refs (Contract W-7405-ENG-82)

(IS-T-64) CFSTI: HC $5.00/MF $1.00

A method is developed for determining with the help of the variation principle the best antisymmetrized product of separated geminals for a poly-atomic system. The strongly orthogonal geminals are determined directly in natural form and the natural orbitals are expressed in terms of Slater-type atomic orbitals. An application to the beryllium-like atomic systems uniformly recovers 90 per cent of the correlation energy. Correction for defects in the calculated wavefunctions gives an estimate of 92 per cent for the correlation energy recovered by the best possible separated pair approximation. The correlation energy recovered is analyzed by a partitioning of the energy into intra- and intergeminal contributions, and both are further resolved into natural orbital contributions. Certain contributions from the weakly occupied natural orbitals are negligible for the intrageminal energy lowerings and for the intergeminal interactions. As a further refinement, the augmented separated pair expansion is developed. The wavefunction is expanded in a series of augmented separated pair configurations of which each term is an antisymmetrized product of certain separated geminals. The leading term is the separated pair approximation; the higher terms are also formed from the natural orbitals of the separated pair approximation. The relatively few contributing configurations can be readily classified. In an application to beryllium only 28 of several hundred configurations contribute more than 10^{-5} a.u. The total correlation energy recovered is 94 per cent. Correction of the defect in the wavefunction gives an estimated value of 96 per cent. The additional correlation energy recovered by the augmented separated pair expansion beyond the separated pair approximation can be identified as due to intergeminal interactions. It is analyzed by a partitioning of the energy in terms of interaction between augmented separated pair configurations. Author (NSA)

N66-30219# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

MEASUREMENT OF THE PARAMETER R IN THE ELASTIC pn-SCATTERING AT 605 MeV AND THE NUCLEON-NUCLEON PHASE SHIFT ANALYSIS

Z. Janout, Yu. M. Kazarinov, F. Lehar, A. F. Pisarev, and Yu. N. Simonov 1 Feb. 1966 20 p refs

(JINR-E-2560)

The triple scattering parameter and the polarization in p–n scattering at 605 Mev were measured using spark chambers. Measurements were made at 90 and 125°. NSA

N66-30225# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Soyuznyi Nauchno-Issledovatel'skii Institut Priborostroeniya.

TYPE 9014-01 ALPHA-RADIATION IONIZATION SPECTROMETER AND ITS USES FOR MEASURING SMALL CONCENTRATIONS OF AEROSOLS OF ALPHA-ACTIVE ISOTOPES [IONIZATSIONNYI SPEKTROMETR AL'FA-IZLUCHENIYA TIPA 9014-01 I EGO PRIMENENIE DLYA IZMERENIYA MALYKH KONTSENTRATSII AEROZOLEI AL'FA-AKTIVNYKH IZOTOPOV]

V. F. Bolotin and O. A. Chutkin 1965 11 p In RUSSIAN *Its* Rept.-1

(NP-15448)

The design and construction of the spectrometer, consisting of a pulse ionization chamber with preamplifier and a framework containing the electronic units, pump, and

manometer, are described. The use of the apparatus for carrying out fast measurements of small concentrations of aerosols of long-lived alpha emitters is discussed. The apparatus also permits careful radiometric analyses of alpha-active solutions and dry materials to be performed. NSA

N66-30228# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

STRUCTURE OF THE GROUND AND EXCITED STATES OF ODD-MASS DEFORMED NUCLEI IN THE REGION 153 ≤ A≤187

V. G. Solov'ev and P. Vogel 28 Jan. 1966 36 p refs
(JINR-E-2561)

The interactions of quasiparticles with quadrupole and octupole phonons in deformed odd-mass nuclei are considered in the framework of the method of approximate second quantization. It is shown that the interaction of quasiparticles with phonons leads to the appearance of admixtures to the one-quasiparticle states and improves the description of these states as compared to the independent quasiparticle model. It is also shown that this interaction leads to the formation of the collective nonrotational states and of the complex structure states in odd-mass nuclei. Author (NSA)

N66-30230# Iowa State Univ. of Science and Technology, Ames.

PHOTONUCLEAR YIELDS AND CROSS SECTIONS FOR THE $^{16}O(\gamma,\alpha n)^{11}C$ REACTION

Gary Kenneth Sanderson (M.S. Thesis) Aug. 1965 47 p refs
(Contract W-7405-ENG-82)
(IS-T-45) CFSTI: HC $2.00/MF $0.50

Bremsstrahlung yield functions for the photoproduction of ^{11}C from ^{16}O were measured from threshold to 65 Mev. The 20 minute radioactive decay of ^{11}C was detected using 0.511 Mev annihilation photons in a 3×5" NaI scintillation detector. Decay curves were obtained on 1 Mev intervals from 25 to 65 Mev. These decay curves were resolved into four components corresponding to half lives of ^{15}O, ^{13}N, and ^{11}C and a time independent background using a least square fitting procedure. Energetic considerations are sufficient to prove that the primary reaction studied is $^{16}O(\gamma,\alpha n)^{11}C$. The yield functions were analyzed using the least structure technique for the cross section. The cross section exhibits a broad maximum of 0.22 mb near 40 Mev with a long shoulder extending to 65 Mev. No fine structure is evident. The cross section integrated to 65 Mev is 4.91±0.85 Mev-mb. Author (NSA)

N66-30231# Ceskoslovenska Akademie Ved, Rez.

ON THE 3^+ LEVEL IN ^{186}OS POPULATED IN THE ^{186}Re β-DECAY

L. Maly and M. Vejs [1965] 10 p refs
(UJV-1456/65)

With the intermediate image spectrometer modified for β–γ coincidences the coincidences of the 400 to 1100-kev transition were measured. The e_L 137–γ 770–kev coincidences were observed. Consequently, in addition to the known 768-kev transition, there is the other one with the closed energy. For this transition the relative intensity ratio $T_{\gamma 632}/T_{\gamma 773} = 8 \pm 2$ was determined. The corrected decay scheme of ^{186}Re is presented. Author (NSA)

N66-30233# Paris Univ. (France). Laboratoire Curie.

MEASUREMENT OF RADIOACTIVITY BY SCINTILLATION IN A LIQUID MEDIUM: BIOLOGICAL USES [MESURE DE LA RADIOACTIVITE PAR SCINTILLATION EN MILIEU LIQUIDE: APPLICATIONS BIOLOGIQUES]

S. Apelgot Brussels, EURATOM, 1965 18 p refs In FRENCH
(Contract EURATOM-030-63-3 BIOF)
(EUR-2459.f)

For quantitative dosing of low-energy β^- particle emitters by the scintillation method in a liquid medium, close contact must be effected between radioactive atoms and scintillating molecules. It is difficult to fulfil this condition in the special case of aqueous solutions or suspensions (customary in biology) which are not miscible with conventional scintillating media. The use of a membrane support eliminates both this difficulty and in general the associated quenching phenomena also. Author (NSA)

N66-30235# Tokyo Univ. (Japan). Institute for Nuclear Study.

NUMERICAL CROSS SECTIONS OF THE REACTION $^{15}N(p,\alpha)^{12}C$ BETWEEN 6.70 AND 15.16 MeV OF PROTON ENERGIES

I. Nonaka, T. Mikumo, K. Matsuka, M. Koike, Y. Nagahara et al
25 Jan. 1966 38 p
(INSJ-95)

Numerical values of the differential cross sections and of the integrated cross sections of the reaction $^{15}N(p,\alpha)^{12}C$ for the ground state α_0-group and the first excited state (4.43 Mev) α_1-group are presented. The incident proton energies ranged from 6.70 to 15.16 Mev. NSA

N66-30238# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.

GAMBLE-4. A PROGRAM FOR THE SOLUTION OF THE MULTIGROUP NEUTRON-DIFFUSION EQUATIONS IN TWO DIMENSIONS, WITH ARBITRARY GROUP SCATTERING, FOR THE IBM-7044 FORTRAN IV SYSTEM

J. P. Dorsey 1 Jul. 1965 50 p refs
(Contract AT(04-3)-167)
(GA-6540) CFSTI: HC $2.00/MF $0.50

GAMBLE-4 is an IBM-7044 FORTRAN IV chain program that finds, over a nonuniform rectangular mesh imposed upon a rectangular area of either the x-y or the r-z plane, a discrete numerical solution to the multigroup, time-independent, neutron diffusion equations for a heterogeneous reactor. The solution is obtained over as many as 300 macroscopic determining regions, using from two to ten lethargy groups and up to 20,000 mesh points. NSA

N66-30240# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

E2-TRANSITION AND E3-TRANSITION PROBABILITIES IN ODD DEFORMED NUCLEI [VEROYATNOSTI E2 I VEROYATNOSTI E3 PEREKHODOV V NECHETNYKH DEFORMIROVANNYKH YADRAKH]

N. I. Pyatov and M. I. Chernei Jan. 1965 12 p refs In RUSSIAN
(JINR-P-2540)

The E2- and E3-transition probabilities in odd deformed nuclei were calculated within the Nilsson model taking into account pairing correlations. Different superfluid wave functions were used. In order to fit the experimental data the effective E2- and E3-charges are introduced. It is shown that one can obtain agreement between theory and experiment using the reasonable values of effective charges and only the

modified superfluid wave functions such as blocked ones, or projected onto space of fixed numbers of particles.
Author (NSA)

N66-30241# Oak Ridge National Lab., Tenn.
CALCULATED FLUXES OF LESS THAN 50-MeV NEUTRONS DIFFUSING BENEATH THE SHIELD OF A MESON PRODUCTION FACILITY
W. E. Kinney 23 Feb. 1966 9 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1423) CFSTI: HC $1.00/MF $0.50

Fluxes of neutrons of energy less than 50 Mev which diffuse beneath an idealized shield for a meson production facility were estimated by Monte Carlo methods. Neutrons from a 400-Mev point isotropic source impinged on the shield configuration, where lower energy neutrons were produced by intranuclear cascades. Neutrons below 50 Mev were then treated, and the fluxes computed by statistical estimation. The fluxes at 0, 5, and 10 ft behind the shield were calculated to be $(2.7 \pm 0.7) \times 10^{-10}$, $(3.6 \pm 1.1) \times 10^{-11}$, and $(1.4 \pm 0.4) \times 10^{-11}$ neutrons cm^{-2} (source neutron)$^{-1}$, respectively. The flux at 0 ft produces an average whole-body dose rate of 3.6 r/hr.
Author (NSA)

N66-30242# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
DIFFRACTION IN MEDIUM-ENERGY NUCLEAR REACTIONS [DIFFRACTION DANS LES REACTIONS NUCLEAIRES A MOYENNE ENERGIE]
Nicole Longequeue (CEN-Grenoble) Aug. 1965 20 p refs In FRENCH
(CEA-BIB-60)

The diffraction model used for nuclear reactions which involve particles having energies of from 10 to 30 Mev often give satisfactory results. However, since the simple diffraction theory does not take into account the spin-orbit coupling, it cannot explain recent experimental results indicating the dependence of the spin on the final state for the angular distributions. An attempt to introduce this spin-orbit coupling was recently made.
Author (NSA)

N66-30243# Osterreichische Studiengesellschaft fur Atomenergie G.m.b.H., Seibersdorf (Austria). Institut fur Chemie.
CALCULATION OF THE ACTIVITY OF Au-198 BY THE IRRADIATION WITH THERMAL NEUTRONS [BERECHNUNG DER ACTIVITAET VON ^{198}AU BEI DER BESTRAHLUNG MIT THERMISCHEN NEUTRONEN]
H. Sorantin [1965] 25 p refs In GERMAN Submitted for Publication
(SGAE-CH-24/1965)

The number of radioactive nuclei formed in the irradiation of gold with thermal neutrons was calculated by various formulas. The resulting activity for a period of 30 days was represented graphically for fluxes from 10^{10} to 10^{15} n cm^{-2} sec^{-1}. For short irradiations (up to 50 hrs), some diagrams for the isotope production were prepared. It was shown that the conventional irradiation formulas for the calculation of the radioisotopes produced must be used only for neutron fluxes up to 10^{13} n cm^{-2} sec^{-1} because of the large capture cross section of ^{198}Au, and must then be replaced by an expanded formula. In thermal neutron fluxes of the order of magnitude of 10^{15} n cm^{-2} sec^{-1}, the decrease of ^{198}Au is so large that the activity of ^{198}Au does not approach saturation but decreases with increasing radiation time. As a result, gold foils can be used as irradiation monitors only in low fluxes; and in the production of ^{198}Au, high neutron fluxes are to be avoided.
Author (NSA)

N66-30244# Brookhaven National Lab., Upton, N. Y. Biology Dept.
THERMOLUMINESCENCE INDUCED BY LOW ENERGY ALPHA PARTICLES
Robert G. Woodley and Noye M. Johnson [1965] 13 p refs Presented at Intern. Conf. on Luminescent Dosimetry, Palo Alto, Calif.
(Contract AT(30-2)-GEN-16)
(BNL-9589; Conf-650637-5) CFSTI: HC $1.00/MF $0.50

Low energy alpha particles are approximately 10–20% as effective as gamma radiation in producing thermoluminescence. Experimental determination was made by irradiating powdered samples of CaF_2 and $CaCO_3$ with polonium-210 alpha particles and by irradiating powdered samples of LiF with thermal neutrons. The thermal neutron irradiation results in the $^6Li(n,\alpha)^3H$ reaction. The geometry of the phosphor crystals was arranged to ensure homogeneous irradiation of the samples. Comparisons were made with equivalent samples which were irradiated with cobalt-60 gamma radiation. The mode of ionization of alpha particles in the materials of this experiment evidently is less efficient than beta or gamma radiation for filling electron traps.
Author (NSA)

N66-30245# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
RESOLUTION OF THE MULTIGROUP SCATTERING EQUATION IN A ONE-DIMENSIONAL GEOMETRY AND SUBSIDIARY CALCULATIONS: THE MUDE CODE [RESOLUTION DE L'EQUATION MULTIGROUPE DE LA DIFFUSION DANS UNE GEOMETRIE A UNE DIMENSION ET CALCULS ANNEXES: CODE MUDE]
Claude Bore, Yves Dandeu, and Chantal Saint-Amand Dec. 1965 193 p In FRENCH
(CEA-R-2923)

The computer program MUDE, which solves a system of difference equations approximating the one-dimensional multigroup diffusion equation, is described. The program is written in FORTRAN II for the IBM 7090–7094.
NSA

N66-30324# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ANGULAR DISTRIBUTIONS OF SLOW CHARGED SECONDARIES IN THE INTERACTIONS OF 9 GeV NEGATIVE PIONS WITH XENON NUCLEI
Marian Danysz, Teodor Siemiarczuk, and Przemyslaw Zielinski Jan. 1966 14 p refs
(INR-683/VI/PH) CFSTI: HC $1.00/MF $0.50

Range and angle of emission of stopping charged secondaries from interactions of 9 GeV negative pions with xenon nuclei in the xenon bubble chamber have been measured. A maximum in the angular distribution at an angle of about 60 degrees with respect to the primary direction is observed.
Author

N66-30406# Brookhaven National Lab., Upton, N. Y. Physics Dept.
PROCEEDINGS OF THE SUMMER STUDY GROUP ON THE PHYSICS OF THE EMPEROR TANDEM VAN DE GRAAFF REGION, VOLUMES I, II, AND III
G. Holland and R. Steiglitz, ed. Dec. 1965 1270 p refs Meeting held 21 Jun.–16 Jul. 1965
(Contract AT(30-2)-GEN-16)
(BNL-948(C-46)) CFSTI: HC $18.14/MF $5.00

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N66-30413# Argonne National Lab., Ill.
THE EFFECT OF INTERFERENCE INTERACTION BETWEEN THE RESONANCES OF Pu^{239} AND Th^{232} ON Pu^{239} FISSION AND CAPTURE CROSS SECTIONS AND Th^{232} CAPTURE CROSS SECTIONS
R. S. Singh Jan. 1966 15 p refs
(Contract W-31-109-eng-38)
(ANL-7144) CFSTI: HC $1.00/MF $0.50

The effect of interference interaction between the resonances of ^{239}Pu and ^{232}Th on Doppler-effect calculations and sodium-void coefficients was investigated. The temperature-dependent effective cross sections for ^{239}Pu and ^{232}Th were evaluated, taking into account both types of interference interactions, namely, the overlap of neighboring resonances in one isotope and the interaction between resonances in one isotope and the interaction between resonances of the two isotopes. A simplified method developed by R. N. Hwang was used to calculate these cross sections over a range of σ_p, the potential-scattering cross section per absorber atom for the two isotopes. Author (NSA)

N66-30417# Atomic Energy Commission, New York. Health and Safety Lab.
AN EXPERIMENTAL DETERMINATION OF DIFFERENTIAL ENERGY AND ANGLE SPECTRA FOR ^{137}Cs γ-RAYS IN SAND
M. Alberg, K. O'Brien, J. Mc Laughlin, and A. Lazanoff Feb. 1966 35 p refs
(HASL-167) CFSTI: HC $2.00/MF $0.50

Differential energy and angle spectra from a point isotropic ^{137}Cs source in an effectively infinite medium of sand were determined for γ-ray penetrations of 1, 2, and 3 mean free paths. The spectra were obtained from scintillation spectrometer measurements by an analytic method based on the Scofield iteration scheme. An integration of the results over all angles yielded differential energy spectra which are consistent with interpolated values of Goldstein and Wilkins' moments method calculations for aluminum. Author (NSA)

N66-30428# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
MEASUREMENTS OF THE NEUTRON DIFFUSION PARAMETERS OF THE ORGANIC GLASS BY MEANS OF THE CHOPPER METHOD [POMIARY NEUTRONOWYCH PARAMETROW DYFUZYJNYCH SZKLA ORGANICZNEGO PRZY POMOCY CZOPERA]
A. Graffstein, Z. Ogrzewalski, T. Rzeszot, A. Stanolow (Bulgarian Inst. of Nucl. Res.), and E. Warda Feb. 1966 18 p refs
(INR-690/IX-A/R) CFSTI: HC $1.00/MF $0.50

The neutron diffusion parameters of the organic glass have been measured by means of the pulsed method using the chopper as a pulsed neutron source. The experimental dependence of the decay constant of the thermal neutron flux as a function of buckling of examined samples was fitted to a power series in B^2 by the method of weighted least squares. Two fits were tried using series which terminated with the B^4 and B^6 terms. Calculations were performed for constant extrapolation length d=0.34 cm and buckling dependent extrapolation length $d=d/B^2$. Author

N66-30446# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati.
CALCULATION OF A NUCLEON CASCADE IN ALUMINUM WITH THE MONTE CARLO METHOD FOR ENERGIES BETWEEN 400 AND 30 MEV [CALCOLO DI UNA CASCATA NUCLEONICA IN ALLUMINIO CON IL METODO DI MONTE CARLO PER ENERGIE TRA 400 E 30 MEV]
M. A. Locci, P. Picchi, and G. Verri 6 Sep. 1965 12 p refs In ITALIAN /Its Internal Note no. 287
(LNF-65/30)

A nucleon cascade generated by fast primary nucleons with a maximum energy of 400 Mev was studied with the purpose of attaining information for the evaluation of the necessary thicknesses for the shielding of the Frascati linear accelerator. The calculation of the cascade was followed in a monodirectional approximation. In the energy range considered, the meson component of the cascade was neglected. In the calculations Al is used as the absorbent, as it is the element having characteristics closest to that of cement normally

used for shielding. The program, however, can be used for any absorbing medium. The calculations were performed with a Fortran program. The program was written for the IBM-7040. The results are given graphically. NSA

N66-30447# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Radiochemie.

ON CALCULATION OF BREMSSTRAHLUNG BACKGROUND IN γ-SPECTRA [ZUR BERECHNUNG DES BREMSSTRAHLUNTERGRUNDES IN γ-SPEKTREN]

E. Gantner and H. Muenzel May 1965 103 p refs In GERMAN

(KFK-321)

The γ spectra of β emitters are always superimposed on a continuum that can be traced back to internal and external bremsstrahlung. The evaluation of such spectra can lead to false results since in the analysis of bremsstrahlung continua by the subtraction method many γ energies appeared at random. The bremsstrahlung fraction, unknown for the most part in form and intensity, should be subtracted from each analysis of the total spectrum. This is especially necessary when radionuclides with high β maximum energy are investigated. From various authors, equations were derived by which the spectral pattern of the internal and external bremsstrahlung can be calculated. From such theoretical spectra, the bremsstrahlung distribution measured with a NaI scintillation spectrometer could be determined approximately with consideration of the response function of the detector. The accuracy with which experimental bremsstrahlung spectra could be calculated in this manner was investigated. The knowledge of the formation probabilities for the external and internal bremsstrahlung is necessary for the calculation of the theoretical spectra. These formation probabilities were determined as a function of the electron and photon energies and were tabulated. Author (NSA)

N66-30449# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON THE ANGULAR DISTRIBUTION OF THE TRANSFER REACTION PRODUCTS [K VOPROSU OB UGLOVOM RASPREDELENII PRODUKTOV REAKTSII PEREDACHI]

B. N. Kalinkin and Ya. Grabovskii 1965 8 p refs In RUSSIAN

(JINR-P-2298)

The consequences of the quasiclassical theory of the angular distribution of the transfer reaction products were considered. The results are consistent with the experimental data. Author (NSA)

N66-30450# Oak Ridge National Lab., Tenn.

THEORETICAL METHODS IN THE DOSIMETRY OF HIGH-ENERGY PARTICLES

J. E. Turner Oct. 1965 26 p refs Presented at the 1st Symp. on Accelerator Radiation Dosimetry and Experience, Upton, N. Y., [1965]

(Contract W-7405-ENG-26)

(ORNL-P-1738; CONF-651109-4) CFSTI: HC $2.00/MF $0.50

Specific nuclear reactions relevant to high-energy particle dosimetry are described and the results of several calculations of dose at high energies are reviewed. For health physics personnel monitoring under normal operating conditions in the vicinity of a high-energy accelerator, neutrons, gamma photons, and muons will generally constitute the most important radiation outside shields. The reactions that give rise to these radiations are described. A summary is given of an ICRP task group report on the estimation of absorbed dose and dose-equivalent for nucleons with energies up to 400 Mev. The calculations treat explicitly nuclear cascade and evaporation processes and multiple nuclear interactions arising from secondary and higher-order reaction products. Pion production was not treated and hence the calculations were applied to nucleons with energies not above 400 Mev. The new estimated flux densities of protons that deliver 2.5 millirem/hr are, for normally incident protons, lower than those given in the Report of ICRP Committee IV (1953–1959) for energies lower than about 215 Mev. At higher energies the newer flux densities for normal incidence are greater than the older ones by factors of about 2 to 3. The newer and older estimates agree well for isotropically incident protons. For neutrons the newer estimates give fluxes that are greater than those given in the previous report by factors of 2 to 3. Figures summarizing these results were prepared. A study is being made of the possible change in absorbed dose and dose equivalent from high-energy nucleons at an interface of soft tissue and bone. Some preliminary results from this work are presented. NSA

N66-30454# General Electric Co., Schenectady, N. Y. Knolls Atomic Power Lab.

LINK. A COMBINED SLOWING-DOWN AND THERMALIZATION PROGRAM WITH A THERMAL CUTOFF OF 3.06 EV

D. Bollacasa and D. T. Goldman 27 Oct. 1965 35 p refs

(Contract W-31-109-ENG-92)

(KAPL-3098) CFSTI: HC $2.00/MF $0.50

The joining of a neutron slowing-down program, FOMENT, with a thermalization program, SWAK, to form a continuous unit, LINK is described. The effect of changing the value of the maximum energy of the thermalization portion to include more of the upscattering contribution is presented. The thermalization program is available as 32-point (0.625 ev), 36-point (0.835), and 78-point (3.06 ev) versions, complete with full scattering kernels to these energies. Results of calculations for sample problems are given, both as average group constants and as detailed flux spectra. The advantage in including upscattering to higher energies is manifest. Author (NSA)

N66-30455# California Univ., Berkeley. Lawrence Radiation Lab.

NUCLEON-NUCLEON POLARIZATION AT 700, 600, 500, AND 400 MEV

David Cheng (Ph.D. Thesis) 1 Jul. 1965 105 p refs

(Contract W-7405-ENG-48)

(UCRL-11926) CFSTI: HC $4.00/MF $0.75

The polarization parameters for the two-nucleon systems were measured at the 184-in. cyclotron at beam energies of 700, 600, 500, 400 and 310 Mev. They are measured for both the pp and pn systems by means of a polarized proton beam initially produced by scattering the external proton beam on a carbon target at ±6 deg, and then scattered in a liquid hydrogen target or a liquid deuterium target. The asymmetry is measured by reversing the sign of the beam polarization by reversing the pC scattering angle. The angular range treated is between 30 and 150 deg in the center-of-mass system, and involves measurements at eight angular positions at each energy. In order to calibrate the beam polarization, the polarization parameter for pC is also measured at the above energies in the forward direction between 8 and 14 deg in the laboratory frame. When fitting both the differential cross section I_0 and polarization, P, with all the data available in this energy region, in terms of power series, the differential cross sections in both the pp and pn systems were found to vary with energy to a greater extent than the

polarization parameters. From these fits, I_0 and P, for the isotopic spin singlet (I = 0) state of the 2-nucleon system is also calculated. NSA

N66-30457# Kernforschungsanlage, Juelich (West Germany). Institut fuer Radiochemie.

ON THE CHEMISTRY OF NUCLEOGENIC CARBON ATOMS [ZUR CHEMIE NUKLEOGENER KOHLENSTOFFATOME]

Gerhard Stoecklin Jul. 1965 102 p refs In GERMAN (JUL-228-RC)

The reactions of ^{11}C recoil atoms with simple aliphatic and alicyclic hydrocarbons, with oxygen, and with methylamine were investigated both in the gaseous and liquid phase. The basic mechanisms of these reactions were studied, and the carrier-free ^{11}C-labeled reaction products were identified and quantitatively determined by radio-gaschromatographic methods. The origin of hot reaction products in hydrocarbons can be explained by insertion reactions of ^{11}C atoms and their secondary species ^{11}CH and $^{11}CH_2$ in C–H compounds. A highly excited intermediate compound arising first can either decay (formation of fragmentation products) or be stabilized (formation of stabilization products). A decrease of the fragmentation products or an increase of the stabilization products (phase effect) was observed in the condensed phase. The insertion reactions were not discriminatory in any of the cases studied, i.e., the energetic radicals cannot distinguish between the various C–H compounds. A principal product in all the hydrocarbons investigated was acetylene–^{11}C, that was proved to be a fragmentation product by a significant phase effect. The yield of this compound showed a marked dependence on the structure of the substrate. The effective cross section for the acetylene products is proportional to the relative number of primary C atoms in the substrate molecule. On the basis of the observed structure and deuterium isotope effects, it was concluded that acetylene–^{11}C was formed exclusively from naked ^{11}C atoms. The second most frequently occurring product in all alicyclic hydrocarbon was ethylene–^{11}C. (113 references are cited.) NSA

N66-30458# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.

CALCULATIONS OF SOME KINEMATICAL RELATIONS IN THE NUCLEAR REACTIONS PROGRAMS FOR THE DIGITAL COMPUTER UMC-1 [OBLICZANIE NIEKTORYCH ZALEZNOSCI KINEMATYCZ-NYCH w REAKCJACH JADROWYCH PROGRAMY DLA MASZYNY CYFROWEJ UMC-1]

Gustaw Pytkowicz Jul. 1965 30 p ref In POLISH (INP-414/PL)

Descriptions and instructions for practical use of programs for the digital computer JMC-1, when calculating kinetic energy in the lab system as a function of an angle, an angle in the cms system as a function of an angle in the lab system, an angle in the lab system as a function of an angle in the cms system, and a coefficient G converting a cross section from the lab system to the system for a product of a two-body nuclear reaction, are presented. Author (NSA)

N66-30459# Tokyo Univ. (Japan). Inst. for Nuclear Study.

REMARK ON 30 GEV JET SHOWERS, PART A

S. Hasegawa, T. Kawamura, N. Yajima, S. Dake, I. Ohata et al 1 Oct. 1965 13 p refs (INSJ-90)

Proton–nucleon and quasi-(proton-nucleon) interactions in emulsion are studied for a primary proton momentum of 30.5 BeV/c. Data from the jets produced by these interactions suggest that: some of the jets may have an essentially asymmetric angular distribution in the CMS; and the intermediate-particle or fireball model may be applicable to the interactions. The similarities of the investigated 30-BeV jets to those having primary energies above several hundred BeV are discussed. NSA

N66-30461# Oak Ridge National Lab., Tenn.

CALCULATION OF THE NUCLEON-MESON CASCADE IN IRON INITIATED BY 1- AND 3-GEV PROTONS AND COMPARISON WITH EXPERIMENT

R. J. Alsmiller and J. Barish (Union Carbide Nucl. Co.) [1965] 13 p refs Presented at the 13th Conf. on Remote Systems Technol., Washington, D. C., [1965] (Contract W-7405-ENG-26) (ORNL-P-1733; Conf-651101-38) CFSTI: HC $1.00/MF $0.50

One-dimensional nucleon-meson cascade calculations have been carried out for the cases of 1- and 3-Bev protons incident on steel. The thick target cross sections are calculated and compared with experimental values. The calculated values are generally larger than the experimental values for large depths. Author (NSA)

N66-30463# Stanford Univ., Calif. Linear Accelerator Center.

EXCHANGE CURRENTS IN THE DEUTERON

Ronald John Alder (Ph.D. Thesis) Jun. 1965 151 p refs (Contract AT(04-3)-400) (TID-22401) CFSTI: HC $5.00/MF $1.00

The electromagnetic structure of the deuteron is studied by field-theoretic methods. The effects of mesonic exchange currents on the deuteron parameters are investigated, using the impulse approximation. The relation of this approach to the dispersion-theoretic, relativistic approach to the analysis of the deuteron structure is discussed. NSA

N66-30464# Princeton–Pennsylvania Accelerator, Princeton, N. J.

NUCLEAR CHEMISTRY RESEARCH AT PRINCETON UNIVERSITY Annual Progress Report, 1964–1965

S. B. Kaufman, R. A. Naumann, and T. D. Thomas 25 Aug. 1965 49 p refs (Contract AT(30-1)-2137) (PPAD-2137-566) CFSTI: HC $2.00/MF $0.50

Results of studies on nuclear properties as revealed by high resolution electron and gamma spectroscopy are reported. Investigations of fission processes and high-energy nuclear- or meson-induced reactions are described. NSA

N66-30465# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.

CAPTURE OF STOPPED π^- MESONS BY LIGHT NUCLEI [ZAKHVAT OSTANOVIVSHIKHSYA π^- MESONOV LEGKIMI YADRAMI]

V. M. Kolybasov 1965 36 p refs In RUSSIAN (NP-15601)

Capture of stopped meson (π^-) by light nuclei of α-particle type (^{12}C, ^{16}O) with the emission of fast protons, neutrons, deuterons and tritons is considered. Relative yields and energy spectra of the final particles are calculated. It is shown that experimental data are in agreement with the assumption about predominant role of the α-particle pole graph. Author (NSA)

N66-30467# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).

PHOTOPRODUCTION OF PION AND NUCLEON RESONANCES AT ENERGIES UP TO 5.5 GeV

U. Brall, G. Reimann, and W. Bothin Sep. 1965 23 p refs (DESY-65/11)

The photoproduction of N^*, π, ω, ρ, and η on protons at 0.3 to 5.5 Bev is observed, using data from 5339 bremsstrahlung reactions in a hydrogen bubble chamber. The production of $N^*(1238)$ is verified. NSA

N66-30472# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.

CONTRIBUTION TO THE STUDY OF (d,p) AND (d,α) REACTIONS ON ^{16}O AND ^{11}B FROM 200 KeV TO 1 MeV [CONTRIBUTION A L'ETUDE DES REACTIONS (d,p) ET (d, α) SUR ^{16}O ET ^{11}B DE 200 KeV A 1 MeV]

Nicole Longequeue (Ph.D. Thesis-Grenoble Univ.) 1965 56 p refs In FRENCH (CEA-R-2807)

The reactions $^{16}O(d,\alpha_0)$, (d,p_0), (d,p_1), and $^{11}B(d,\alpha_0)$, (d,α_2), (d,p_0) were studied from 200 kev to 1 Mev. The interpretation (d,α) reactions by the compound nucleus theory has shown the presence of ^{18}F levels (7.94-Mev, 1 +; 8.09-Mev, 1+) and of ^{13}C level (19-Mev, $3/2\pm$ or $5/2-$). The interpretation of $^{16}O(d,p_1)$ and $^{11}B(d,p_0)$ reactions at energies lower than 400 kev was given by a theory of Coulomb stripping. Author (NSA)

N66-30475# Oak Ridge National Lab., Tenn.

THE HAUSER-FESHBACK NUCLEAR SCATTERING COMPUTER CODE LIANA

William R. Smith 20 Sep. 1965 28 p refs (Contract W-7405-ENG-26) (ORNL-TM-1234) CFSTI: HC $2.00/MF $0.50

The FORTRAN code LIANA computes the scattering angular distribution and integrated cross section for any two-particle nuclear reaction. The input and output are essentially the same as that for the code described previously, but the present calculation is more general and, in addition, includes a nonlocal potential and a Porter-Thomas width-fluctuation correction. A listing of the program is included. Author (NSA)

N66-30477# National Lead Co. of Ohio, Cincinnati.

A CRITICAL EVALUATION OF THE ABSORPTION AND FLUORESCENCE CORRECTIONS IN QUANTITATIVE MICROPROBE ANALYSIS

J. W. Colby and D. K. Conley 23 Aug. 1965 23 p refs Presented at 4th Intern. Conf. on X-ray Optics and Microanalysis, Paris, 7–10 Sep. 1965 (Contract AT(30-1)-1156) (NLCO-960; Conf-690952-1) CFSTI: HC $1.00/MF $0.50

A set of Cr–Fe alloys was prepared, checked for homogeneity, and chemically analyzed. The alloys were then analyzed in the microprobes of two different labs using a variety of analytical conditions. The K radiation x-ray intensity ratios obtained in the two labs were compared (after correction for dead-time and background), the results were averaged, and all data were corrected for absorption and fluorescence by characteristic radiation using most of the more popular and practical techniques. Conclusions regarding the methods used are discussed. Author (NSA)

N66-30485# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

REAL PART OF ZERO-ANGLE ELASTIC π-N SCATTERING AMPLITUDE AND CHARGE EXCHANGE CROSS SECTION AT HIGH ENERGIES [REALNAYA CHAST AMPLITUDY UPRUGOGO π-N RASSEYANIYA NA NULEVOI UGOL I SECHENIE PEREZARYADKI V OBLASTI VYSOKIKH ENERGII]

V. S. Barashenkov 1965 8 p refs In RUSSIAN (JINR-P-2397)

More accurate results of calculation of the real part of elastic $\pi^{\pm}$-p forward scattering amplitude are given. The effect of the asymptotic behavior of the cross sections σ_{tot} ($\pi^{\pm}$-p) is discussed. A discrepancy with experimental data at 10 to 30 Bev is pointed out both in the energy dependence of the real part and in the difference sign of the real parts of the π^--p and π^+-p scattering amplitudes. Author (NSA)

N66-30495# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.

PHASE MOTION OF PROTONS IN A PROTON LINEAR ACCELERATOR WITH A PERTURBED AXIAL FIELD [RUCH FAZOWY PROTONOW W LINIOWYM AKCELERATORZE PROTONOWYM Z ZABURZONYM POLEM AKSJALNYM]

J. Sura Nov. 1965 34 p refs (INR-640/SLBAL/E) CFSTI: HC $2.00/MF $0.50

The effect of a modulation of the axial electric field on the phase acceptance in a proton linear accelerator is considered. The numerical solution of the equation of phase motion gives for a small modulating frequency a decrease of acceptance, which is comparable to that caused by the decrease of the level of flat field. For high modulating frequency a range of stable input phase deviations is almost the same as for an unperturbed field and amounts approximately $3(\phi_s)$. Author

N66-30496# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.

A SEMICONDUCTOR SYSTEM FOR CHARGED PARTICLES IDENTIFICATION [POLPRZEWODNIKOWY UKLAD DO ROZROZNIANIA CZASTEK NALADOWANYCH]

J. Chwaszczewska, L. Freindl, W. Karcz, W. Przyborski, and M. Slapa Jan. 1966 24 p refs Submitted for Publication (Rept.-444/PL) CFSTI: HC $1.00/MF $0.50

A system consisting of two semiconductor counters was built to separate particles from resulting nuclear reaction. The geometry of the detectors is shown, and the electronic circuits are illustrated by block diagrams. Measurements were performed to test the semiconductor counter telescope working with the electronic system. The energy spectra of 24.8 MeV alpha particles and 12.4 MeV deuterons elastically scattered on a gold target placed in the center of the scattering chamber were observed. After measurement with the gold target, all parameters were fixed and particles from reactions induced by alpha particles and deuterons on carbon and calcium targets were identified. The following conclusions were reached: measurements at the cyclotron (presence of high frequency fields) require special screening of charge preamplifiers and a special system of grounding; a delay-line to compensate the delay connected with the oscilloscope-scintillation counter branch is required; and the different rise-times for the two counters also needed correction. L.E.W.

N66-30508# RAND Corp., Santa Monica, Calif.

A PRELIMINARY INVESTIGATION OF TRANSPORT-BRANCHING PROCESSES

Bernard Shiffman Mar. 1966 34 p refs
(Contract ARPA SD-79; ARPA Order 189-61)
(RM-4290-ARPA; AD-632534) CFSTI: HC $2.00/MF $0.50

A probabilistic discussion of one-dimensional multitype neutron transport processes is given, and the invariant imbedding technique is applied to the generating functions of the emitted neutrons. A system of simultaneous partial differential equations for these generating functions is then derived. The well-known Ricatti equation for the expected reflected flux follows from these differential equations.
Author (TAB)

N66-30553# Naval Radiological Defense Lab., San Francisco, Calif.
RESPONSE OF LiF TO NEUTRONS AND CHARGED PARTICLES
Catherine L. Wingate, Eugene Tochilin, and Norman Goldstein 28 Sep. 1965 38 p refs
(USNRDL-TR-909; AD-624127) CFSTI: HC $2.00/MF $0.50

The thermoluminescent response of LiF was investigated with thermal neutrons and with fast neutrons at energies extending from 0.26 to 14 Mev. The results indicated that thermal neutron fluence may be conveniently measured with normal LiF but a higher readout temperature is required than for gamma dose measurements. Studies of fast neutron response with Li^{7}F to minimize thermal effects) showed a low neutron sensitivity which was strongly dependent on energy. Fast neutron response was also investigated for a dosimeter in which the powder was suspended in alcohol. The LET response of LiF was studied using alpha particles with energies from 900 Mev down to 2 Mev. Author (TAB)

N66-30566# Princeton Univ., N. J. Palmer Physical Lab.
DIRECT (p,α) REACTIONS ON ISOTOPES OF COPPER AND ZINC
Jerry A. Nolen, Jr. (Ph.D. Thesis) Aug. 1965 160 p refs
(Contract AT(30-1)-937)
(PUC-937-171A) CFSTI: HC $5.00/MF $1.00

The (p,α) direct reaction was studied at a bombarding energy of 17.5 Mev. Isotopic targets of ^{63}Cu, ^{65}Cu, ^{64}Zn, ^{66}Zn, ^{68}Zn, and ^{70}Zn were used. Thin target data with 100 kev total energy resolution were obtained for four of these isotopes. The experiment was performed with an array of six solid state particle detectors. The Q values of the ground state transitions were found to agree within the experimental error of ±20 kev with those given in published mass tables. Three excited energy levels were populated in the previously unexplored ^{67}Cu nucleus. They are at excitation energies 1.12±0.05, 1.67±0.05, and 2.34±0.05 Mev. Angular distributions of the alphas leading to the ground states and several excited states are presented for all six targets. These angular distributions were found to be characteristic of the angular momentum transfer. The corresponding curves from the different targets are very similar. There is very little Q value dependence in the shapes over a range of 3 Mev. A Striking difference between the L=1, J=1/2, and J=3/2 transitions was observed. The (p,α) spectra of a given residual nucleus was shown to be very similar to that of single proton pickup leading to the same nucleus. The resulting usefulness of the (p,α) reaction in locating proton hole states is pointed out. Levels which probably correspond to the four ($p_{3/2}f_{7/2}^{-1}$) proton hole states in ^{60}Ni were observed. The $f_{7/2}$ proton holes in the Cu isotopes were also located near 1.5 Mev excitation energy. There were two strong 7/2$^-$ levels in each copper isotope. The implications of these low lying hole states for unified model calculations were discussed. The "collective" levels of ^{60}Ni and ^{62}Ni were excited appreciably by the (p,α) reaction. Relative yields to the 0$^+$, 2$^+$, and 4$^+$ members of the two phonon triplet were measured. The yield to the 0$^+$ state is only about 5 percent of that to the other two members. The low lying 1/2$^-$ and 5/2$^-$ levels of the Cu isotopes were very weakly excited. The distorted waves model of the (p,α) pickup mechanism is discussed in detail. Special cases are worked out and the method of calculation of (p,α) form factors is given. The distorted waves calculations reproduce the qualitative features of the data, but the shapes do not fit well. The choice of parameters is discussed. Author (NSA)

N66-30569# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
COMPUTING THE EFFECTIVENESS OF A RECOIL PROTON RADIATOR IN A FIELD OF ISOTOPIC NEUTRON RADIATION [RASCHET EFFEKTIVNOSTI RADIATORA PROTONOV OTDACHI V POLE IZOTROPNOGO IZLUCHENIYA NEITRONOV]
Pshona Stanislav 1965 8 p refs In RUSSIAN
(NP-15466)

An expression is derived for the effectiveness of a radiator of recoil protons in a field of isotropic neutron radiation, for any given energy discrimination. The results of calculations for neutron energies of 0.2 to 20 Mev are presented. Author (NSA)

N66-30572# Tokyo Univ. (Japan). Inst. for Nuclear Study.
NUMERICAL DIFFERENTIAL CROSS SECTIONS OF SOME REACTIONS ON ^{12}C INDUCED BY 54.9 MeV PROTONS
H. Taketani, H. Yamaguchi, J. Muto, J. Kokamo, and H. Itoh (Kyoto Univ.) et al 29 Sep. 1965 23 p ref
(INSJ-88)

Numerical differential cross sections of (p,p), (p,p'), (p,d) and (p,t) reactions on ^{12}C are presented. The target used was ~100μ polyethylene (8.21 mg/cm^2). The energy of the incident protons accelerated with the INS synchrocyclotron was 54.9±0.4 Mev. Momentum analysis of the reaction products was performed with a system of magnetic analyzer which was operated with momentum resolution of about 0.3%. Nuclear photographic plates of 100μ thickness were placed along the focal plane of the magnet and were used for the detection of the reaction products. In (p,p') reactions, five prominent proton groups corresponding to the excitation energies of 4.43, 7.66, 9.64, 12.71, and 15.11 Mev in ^{12}C were observed. Angular distributions were obtained for these groups only. In (p,d) reactions, six prominent deuteron groups corresponding to the ground, first (1.99 Mev), second (4.38 Mev), third (4.82 Mev), fourth plus fifth (6.34 and 6.48 Mev), and sixth (6.90 Mev) excited states in ^{11}C were observed. Angular distributions were obtained for these groups only. In (p,t) reactions, only two prominent triton groups corresponding to the ground and first (3.34 Mev) excited states in ^{10}C were observed. Angular distributions were obtained for these groups only. Absolute cross sections were obtained in comparison with those of elastic scattering of protons by hydrogen nuclei contained in the polyethylene target. NSA

N66-30574# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Servizio Documentazione.
A POSSIBLE EXPERIMENT WITH A PROTON POLARIZED TARGET
P. Bounin 19 Jul. 1965 28 p refs *Its* Nota Interna No. 283
(LNF-65/22)

The principles of construction of a polarized proton target and a possible experiment in which a deviation of the Born approximation formula in elastic e-p scattering might be detected are described. A particular experiment which fits very well with the possibilities of the Frascati Laboratory and which is suggested by recently published results is proposed. NSA

N66-30575# Oak Ridge National Lab., Tenn.
ANALYSIS OF ELASTIC AND INELASTIC SCATTERING OF NEUTRONS FROM ^{206}Pb, ^{208}Pb, AND ^{209}Bi BELOW 4.5 MeV
William R. Smith 27 Sep. 1965 17 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1238) CFSTI: HC $1.00/MF $0.50

The Hauser–Feshbach compound-nucleus scattering theory has been applied to neutron elastic and inelastic scattering from ^{206}Pb, ^{208}Pb, and ^{209}Bi in the energy range of 0.8 to 4.5 Mev. The theory appears to work quite well both for the compound-elastic scattering and for the inelastic scattering, provided the imaginary potential W has the correct energy dependence. The results show that for the isotopes considered W should be constant as a function of bombarding-minus-excitation energy and nearly constant above 4 Mev as a function of bombarding energy, but should be made increasingly smaller as the bombarding energy is lowered below this amount. Author (NSA)

N66-30581# Brookhaven National Lab., Upton, N. Y.
THE INTERPRETATION OF PULSED NEUTRON EXPERIMENTS
Noel Corngold Dec. 1965 27 p refs
(Contract AT(30-2)GEN-16)
(BNL-9770; CONF-660203-2) CFSTI: HC $2.00/MF $0.50

Neutron experiments carried out in non-multiplying media, which are homogeneous in composition and simple in shape, are discussed. The problem of decay constants (time eigenvalues) for a particular system is discussed. Solutions were derived for an infinite media. Some of these results are applied to water, heavy water, beryllium, and graphite. NSA

N66-30584# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
PION PRODUCTION IN THE N + N → N + N + π REACTION ON POLARIZED NUCLEONS IN THE OPE MODEL [OBRAZOVANIE π-MEZONOV V REAKTSII NN → NNπ NA POLYARIZOVANNYKH NUKLONAKH V MODELI ODNOPIONNOGO OBMENA]
S. B. Nurushev and V. L. Solovyanov 1965 22 p refs In RUSSIAN
(JINR-P-2382)

Assuming that inelastic nucleon-nucleon interaction involving single pion production can be described by the one-pion exchange diagram a calculation is made of energy spectra and left-right asymmetry in pion emission by collisions of 600 Mev polarized protons with unpolarized target protons. The results of calculations are in quantitative agreement with experimental data on positive pion production in the pp → pnπ^+ reaction. Author (NSA)

N66-30641# Massachusetts Inst. of Tech., Cambridge.
NEUTRON AND GAMMA-RAY SPECTROSCOPY AND ACTIVATION ANALYSIS Final Report, Jan. 1, 1961–Jan. 1, 1966
Norman C. Rasmussen and Theos J. Thompson Bedford, Mass., AFCRL, Feb. 1966 179 p refs
(Contract AF 19(604)-7492)
(MITNE-70; AFCRL-66-135; AD-633252) CFSTI: HC $5.00/MF $1.00

The objectives of this contract were to carry out basic research in the areas of neutron spectroscopy and dosimetry, gamma-ray spectroscopy and dosimetry, and activation analysis techniques. Early work in gamma-ray spectroscopy was done mostly with the bent crystal spectrometers and the triple coincidence scintillation spectrometer which were used in capture gamma-ray studies. Later, however, all the work in gamma-ray spectroscopy was in the development and application of lithium drifted Ge(Li) solid state detectors. A description is included of the fabrication techniques used and the application of these detectors to the study of capture gamma-rays and spent reactor fuel. Work on problems of neutron spectroscopy and dosimetry are described. This work resulted in an improved method for measuring fast neutron spectra through the use of foils. The work done in activation analysis is summarized. TAB

N66-30654# New York Univ., N. Y. Dept. of Physics.
ATOM BEAM STUDIES NO. 3 Final Report, 1 May 1965–30 Apr. 1966
Benjamine Bederson [1966] 9 p
(Grant DA-ARO-D-31-124-G631)
(AROD-3521-7; AD-632850) CFSTI: HC $1.00/MF $0.50

Brief summaries are given of work on electron scattering by atomic oxygen, beam measurements, the polarizability of metastable mercury, and electron-potassium interactions. TAB

N66-30801# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.
ISOTOPIC SPIN VECTOR COUPLING IN THE ELEMENTARY PARTICLE STRUCTURE
K. S. Suh Jun. 1966 45 p refs
(RE-225)

An isotopic spin vector coupling model, or simply a vector model, in the elementary particles is discussed, and evidences that isotopic spin vector couplings may exhibit important roles in the elementary particle structure are presented. By using the coupling constants obtained from a few low energy baryon states, not only all of the observed baryon states can be correctly pinpointed in one-to-one correspondence, but also, in principle, prediction can be made of an endless number of series of multiplets. In this sense, the theory that is presented in this paper can be compared to the Bohr model in atomic physics. The possible implication of meson resonances is discussed from this new perspective. General properties of elementary particles, in the light of this model, are also discussed. Author

N66-30806# Paris Univ. (France).
LUMINESCENCE OF CADMIUM SULFIDE UNDER ELECTRON BOMBARDMENT [LUMINESCENCE DU SULFURE DE CADMIUM SOUS BOMBARDEMENT ELECTRONIQUE]
Francois Bombre (Ph.D. Thesis) 1965 124 p refs In FRENCH *Its* Ser. A. No. 4470
(Contracts N62558-2720; N62558-3576; N62558-3881)
(NP-15110)

Cathode luminescence was used to study the luminescence of cadmium sulfide in the vicinity of the absorption limit. The essential points acquired in cathode luminescence

are first reviewed. The properties and the electron structure of cadmium sulfide are reviewed and a brief survey is made of the experimental results obtained previously on the luminescence at 4° and 77°K and at room temperature. The experimental apparatus used to study the radiation emitted and the various results obtained after a variation of the experimental parameters are described. It is shown how the results obtained can be interpreted within the framework of the present theories. NSA

N66-30807# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Institut fuer Kernphysik.
CROSS SECTION FLUCTUATIONS IN THE REACTION ^{27}Al (p,γ)^{28}Si, ^{27}Al(p,p' γ) ^{27}Al AND ^{27}Al(p,α γ)^{24}Mg [UNTERSUCHUNG VON STATISTISCHEN FLUKTUATIONEN BEI DEN REAKTIONEN ^{27}Al(p,γ) ^{28}Si, ^{27}Al(p,p' γ)^{27}Al UND ^{27}Al (p,α γ) ^{24}Mg]
F. Rauch Dec. 1965 58 p refs In GERMAN
(IKF-15)

The reaction ^{27}Al(p,γ)^{28}Si was studied in the energy range E_p = 4.0 to 6.7 Mev. Excitation functions at 90° were measured for the transitions to the ground state and the first excited state of ^{28}Si in 12-kev steps. Angular distributions were taken for $4.0 < E_p < 4.3$ and $5.5 < E_p < 5.8$ Mev. Besides, excitation functions were measured for 4 of the gamma transitions in the reactions ^{27}Al(p,p'γ)^{27}Al and ^{27}Al(p,$\alpha\gamma$)^{24}Mg for $4.0 < E_p < 6.0$ Mev in steps of 12 and 8 kev. All excitation functions show strong fluctuations. A correlation analysis yields values for the level width in the compound nucleus ^{28}Si. Calculations give a strong dependence of the level width on spin, parity, and isospin. The analysis of the angular distributions of γ-rays from ^{27}Al(p,γ)^{28}Si shows the radiation to be essentially of E1-type. Author (NSA)

N66-30814# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON A POSSIBILITY OF DETERMINING ELECTROMAGNETIC FORM-FACTORS OF THE W-MESON [OB ODNOI VOZMOZHNOSTI OPREDELENIYA ELEKTROMAGNITNYKH FORM-FAKTOROV W-MEZONA]
Doan-Nhuong 1 Oct. 1965 6 p refs In RUSSIAN
(JINR-P-2381)

The electromagnetic vertex of the intermediate meson with spin 1 depends on three unknwon form-factors G_1, G_2, G_3. It is pointed out that on the basis of the experiments on polarized proton and antiproton annihiliation it is possible to determine the values of these form-factors, i.e., the values of the anomalous magnetic and quadrupole electric moment of the W-meson. Author (NSA)

N66-30817# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoie Energii, Moscow (USSR). Institut Atomnoi Energii.
SHELL EFFECTS IN THE ENERGY OF NUCLEI [EFFEKTY OBOLOCHEK V ENERGII YADRA]
V. M. Strutinskii 1965 24 p refs In RUSSIAN
(IAE-878)

Nuclear shells correspond to some inhomogeneous distribution of nucleons in phase space, while in quasiclassical phenomenological models, such as the drop model, the nucleon distribution is assumed to be homogeneous. The shell correction to the crop-model energy of the nucleus is calculated as a function of the nucleon number and the deformation, using the Nilsson level scheme. The magnitude of this correction is in agreement with the known value for the semiempirical formulas for nuclear mass. The calculated nuclear deformation and the boundaries of the shells of deformation also agree with experiment. The pairing energy is calculated, but it does not play a substantial role. Author (NSA)

N66-30818# United Nuclear Corp., White Plains, N. Y. Development Div.
SHIELD SMALL SOURCE EXPERIMENTS
R. Schamberger and J. Celnik 6 May 1965 118 p refs Prepared for Gen. Motors, Indianapolis, Ind. *Its* Rept.-2
(Contract AT(30-1)-3078)
(UNC-5118; MCR-3217) CFSTI: HC $4.00/MF $0.75

MCR shield design analytical techniques and cross sections were tested by comparing calculations with measurements for experiments emphasizing the secondary gamma ray production in specific test materials. Measurements were made with a gamma ray spectrometer behind a configuration consisting of a layer of gamma ray shielding material (the test sample) adjacent to a small Po–Be neutron source, followed by neutron and gamma ray shielding material to reduce extraneous detector response. Calculations of spectrometer response for samples of lead, tungsten, and titanium hydride were performed with a three-dimensional Monte Carlo code, derived from the one-dimensional Monte Carlo codes used in the MCR preliminary design shield analysis. The calculations generally gave very satisfactory predictions of the measurements, the agreement being within twice the uncertainty in the experiment. Differences between the measured and calculated responses indicated that some of the cross sections used, particularly for lead, were low and should be revised. Author (NSA)

N66-30819# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria). Institut für Chemie.
^{99m}Tc GENERATOR USING Fe_2O_3 AS SORBENT FOR ^{99}Mo
S. Bulbulian, B. Bauer, and H. Sorantin Jun. 1965 12 p refs Submitted for Publication
(SGAE-CH-18/1965)

Carrier free ^{99m}Tc was obtained using a generator, which was filled with Fe_2O_3 and then loaded with ^{99}Mo. Elutions were made with 0.1 N HNO_3 at different intervals of time getting a high specific activity of ^{99m}Tc. The over-all yield was 55–70%. The results of laboratory and hospital scale tests are reported. Author (NSA)

N66-30824# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoie Energii, Moscow (USSR). Institut Teoreticheskoi i Eksperimental'noi Fiziki.
PULSED ION SOURCE WITH POINT CATHODE (NEEDLE) [IMPUL'SNYI IONNYI ISTOCHNIK S KATODNOI IGLOI]
Yu. Ya. Lipitskii and V. S. Khoroshkov 1965 10 p refs In RUSSIAN; ENGLISH summary *Its* Rept.-380
(NP-15788)

The pulsed cold cathode ion source with fixed discharge region is described. The ion emission current is 0.3. The working resource of the source is several thousand hours. Gas consumption is 25 cm^3/hour. Power dissipated in the source is 35 watts. Author (NSA)

N66-30829# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.
REPORT ON GAS-FILLED THRESHOLD CHERENKOV COUNTER [BERICHT UEBER GASGEFUELLTE SCHWELLEN-CERENKOV-ZAEHLER]
S. Galster and G. Hartwig Jul. 1965 14 p refs In GERMAN
(KFK-342)

Cherenkov counters are velocity-sensitive counters for charged high-energy particles. For synchrotron electron scattering experiments on a 6-Bev electron synchrotron, two types of threshold Cherenkov counters (SCZ I and SCZ II) with gas filling of CF_3Cl are constructed to differentiate between the extremely relativistic electrons in a divergent beam of pulsed analyzed electrons, μ mesons, and π mesons. SCZ I is divided optically into 5 equal sections because of its large size. SCZ II is a smaller counter, which optically corresponds to one section of the SCZ I. Author (NSA)

N66-30830# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.

THE INFLUENCE OF LONGITUDINAL MAGNETIC FIELDS IN TARGETS ON THE CIRCULAR POLARIZATION OF EXTERNAL BREMSSTRAHLUNG [DER EINFLUSS LONGITUDINALER MAGNETFELDER IM TARGET AUF DIE ZIRKULARPOLARISATION DER AUSSEREN BREMSSTRAHLUNG]

Herwig Schwarz May 1965 36 p refs In GERMAN
(KFK-329)

Bisi et al. reported that if targets were placed in magnetic fields, which were approximately parallel and antiparallel to the electron pulse, there was a change of the polarization degree of the external bremsstrahlung, dependent on the direction and intensity of the magnetic field in the target. These effects were investigated with an improved research installation on a ferromagnetic target in order to test whether the effects reported corresponded to an actual change of the polarization degree, whether they were caused by secondary effects as the polarization-dependent absorption of the external bremsstrahlung in magnetized iron or whether an error occurred in the measurement. The circular polarization of the external bremsstrahlung was measured by Compton scattering on the partially polarized electrons of a cylindrical scattering magnet. The measurements, made in two energy regions (309 to 378 keV and 391 to 587 keV), showed that the circular polarization of the external bremsstrahlung was independent of the direction and intensity of the magnetic field at both energy regions. The effect of the polarization-dependent absorption of the external bremsstrahlung in the magnetic target on the circular polarization of the external bremsstrahlung was studied. In strong magnetic fields, the alteration of the circular polarization is 2.3×10^{-3}. Author (NSA)

N66-30834# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Teoreticheskoie i Eksperimental'noi Fiziki.

LARGE SCINTILLATION COUNTERS AND COUNTERS FOR OPERATION IN MAGNETIC FIELDS [BOL'SHIE STSINTILLYATSIONNYE SCHETCHIKI I SCHETCHIKIDLYA RABOTY V MAGNITNYKH POLYAKH]

G. L. Bayatyan, Yu. V. Galaktionov, O. Ya. Zel'dovich, and L. G. Landsberg 1965 16 p refs In RUSSIAN; ENGLISH summary
(NP-15597)

The results of investigations of large scintillation counters, 700×350×150 mm, using a single photomultiplier as well as of counters with long lightpipes and with magnetic field compensation, for work in strong magnetic fields, are given. Author (NSA)

N66-30844# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Experimentelle Kernphysik.

PULSE SHAPE DISCRIMINATION IN HALF-LIFE DETERMINATION FOR A STUDY OF (γ, α) REACTIONS [IMPULSFORMDISKRIMINIERUNG BEI HALBLEITERZAEHLERN ZUR UNTERSUCHUNG VON (γ, α)-REAKTIONEN]

Helmut Gehm and Horst Ullrich Jun. 1965 30 p refs In GERMAN
(KFK-335)

A method for pulse-form discrimination for semiconductor counters is developed and tested. The method makes possible the discrimination of α particles and protons, and thereby the measurement of photoalpha particles in the presence of an interfering proton and electron background. The efficiency of the method is discussed and illustrated on the reaction $^{27}Al(\gamma,\alpha)^{23}Na$. For this reaction the yield ratio $Y(\gamma,\alpha)/(\gamma,p)$ can be measured. The experimental α spectrum is compared with the α spectrum calculated by the statistical theory. Author (NSA)

N66-30845# Lyon Univ. (France). Institut de Physique Nucleaire.

ON A METHOD OF STUDY OF PARTICLE DYNAMICS IN A LINEAR ACCELERATOR [SUR UNE METHODE D'ETUDE DE LA DYNAMIQUE DES PARTICULES DANS UN ACCELERATEUR LINEAIRE]

Alain Ferat (Ph.D. Thesis) 29 Apr. 1965 84 p refs In FRENCH
(NP-15340)

A method for the study of the particle dynamics in linear accelerators that is adapted to numerical calculations was perfected. The principle of the Alvarez linear accelerator is reviewed and the new principles proposed with respect to the structure and the focusing are discussed. A method of numerical study, based on the systematic development of all the variable quantities as a function of successive powers of some infinitely small variables each corresponding to a well determined effect was proposed. The method makes it possible to appreciate neglected terms when the study is limited to the given order and to know the relative influence of various effects. The study is made by means of reduced variables which gives it a great generality and avoids the necessity of choosing systems of use. NSA

N66-30864# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

A NOTE ON THE DERIVATION OF SUM RULES FROM THE EQUAL TIME COMMUTATION RELATIONS FOR THE SPACE COMPONENTS OF CURRENT DENSITIES

C. Bouchiat and Ph. Meyer May 1966 9 p refs
(TH-151) CFSTI: HC $1.00/MF $0.50

A general method was recently given for deriving sum rules from the algebra of both space and time components of the current densities. In the case of space components, it is impossible to write equal time commutation relations for the current densities in a form where the dependence on a particular frame of reference has disappeared. In this derivation, the chosen frame was the Breit system of the two particles between which the commutator was sandwiched. The possibility of using another frame has been considered. This note shows that the very strong assumptions necessary to derive sum rules imply that the Breit frame is the only possible choice. Author

N66-30892# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.

DE-EXCITATION OF NI NUCLEI AFTER THERMAL NEUTRON CAPTURE [VYSVECHIVANIE YADER NIKELYA POSLE ZAKHVATA TEPLOVOGO NEITRONA]

L. V. Groshev, A. M. Demidov, and N. Shadiev 1965 12 p refs In RUSSIAN
(IAE-885)

Gamma-transition schemes of the nuclei ^{59}Ni, ^{61}Ni, and ^{63}Ni were constructed on the basis of data obtained in measurements of the gamma spectrum from the (n,γ) reaction on nickel isotopes. A comparison of the emission of protons in the (d,p) reaction with the matrix elements of gamma transitions from the initial state is presented. The mechanism of capture of thermal neutrons in these nuclei is discussed. Author (NSA)

N66-30893# Oak Ridge National Lab., Tenn.
THE MEASUREMENT OF NEUTRON TOTAL CROSS SECTIONS IN THE RESONANCE ENERGY REGION AND THE DETERMINATION OF RESONANCE ABSORPTION
J. A. Harvey [1965] 32 p refs Presented at the Am. Nucl. Soc. Meeting, San Diego, Calif.
(Contract W-7405-ENG-26)
(ORNL-P-1885; CONF-660204-2) CFSTI: HC $2.00/MF $0.50

A method of determining resonance absorption cross sections from measurements of total cross sections is demonstrated using transmission data obtained on the low-energy resonances of tungsten isotopes. NSA

N66-30895# International Centre for Theoretical Physics, Trieste (Italy).
SOME REMARKS ON THE CONSTRUCTION OF INVARIANTS OF SEMI-SIMPLE LOCAL LIE GROUPS
T. S. Santhanam 2 Dec. 1965 10 p refs Submitted for Publication
(IC-65-86)

A general form of the *l* invariants of compact semi-simple local Lie groups of rank *l*, as the traces of the powers of the velocity potential operator, is suggested. The connection of this form of the invariants with those of Gruber is described. The possible generalization beyond those of the adjoint group is discussed. Author (NSA)

N66-30897# California Univ., Livermore. Lawrence Radiation Lab.
MEASUREMENT OF GAMMA RAY INDUCED SECONDARY ELECTRON CURRENT FROM VARIOUS ELEMENTS
Paul J. Ebert and Alfred F. Lauzon 15 Sep. 1965 24 p refs Presented at the IEEE Nucl. Sci. Symp., San Francisco
(Contract W-7405-ENG-48)
(UCRL-14270, CONF-651001-16) CFSTI: HC $1.00/MF $0.50

Knowledge of the angular distribution and absolute efficiency for gamma ray induced secondary electron currents is necessary in the development of fast radiation detectors, in dosimetry and in transient radiation effects studies. The angular distribution of the emergent forward electron current and the absolute quantum efficiency for 1.25-Mev gamma ray induced secondary electron current was measured for elements having atomic numbers 6, 13, 29, 48, and 82. To ensure electron equilibrium, targets of thickness about equal to the extrapolated range of a 1.25 Mev photoelectron were used. The non-equilibrium thickness of one-tenth the extrapolated range was also used. A significant difference between the total target current and the total forward current was observed. This difference increased with atomic number and target thickness, as would be expected from results of electron backscattering experiments. Forward currents, calculated as a function of atomic number and target thickness, using Mar's universal electron transmission formula and taking into account both Compton and photoelectric effects, agree well with experimental results. Author (NSA)

N66-30904# Bettis Atomic Power Lab., Pittsburgh, Pa.
THE PDQ-5 AND PDQ-6 PROGRAMS FOR THE SOLUTION OF THE TWO-DIMENSIONAL NEUTRON DIFFUSION-DEPLETION PROBLEM
W. R. Cadwell, P. F. Buerger, and C. J. Pfeifer Jan. 1965 81 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-477) CFSTI: HC $3.00/MF $0.75

PDQ-5 and PDQ-6 are FORTRAN programs which solve the two-dimensional neutron diffusion-depletion problem with up to five lethargy groups. The geometry is rectangular or cylindrical in PDQ-5 and hexagonal in PDQ-6. Both programs provide for variable mesh spacing. Problems in excess of 50,000 mesh points have been run successfully. Author (NSA)

N66-30908# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
EIGHTFOLD FORMALISM IN SU(3) AND 10- AND 27-PLETS [VOS'MIRICHNYI FORMALIZM V SU(3) I 10- I 27-PLETY]
V. I. Ogievetskii and I. V. Polubarinov 1966 21 p refs In RUSSIAN
(JINR-P-2559)

A vector (eightfold) formalism in SU(3) is developed in which the octets are represented in terms of a one-index quantity, whereas the 10- and 27-plets are represented by two-index tensors. A complex set of 8 × 8 matrices is constructed and a number of relations characterizing the algebra of these matrices was obtained. Author (NSA)

N66-30909# Maryland Univ., College Park. Dept. of Physics and Astronomy.
A STUDY OF NEUTRAL HYPERON AND NEUTRAL KAON PRODUCTION IN K^- + p INTERACTIONS NEAR THE Y^* (1765) RESONANCE Technical Report No. 545
Ronald Paul Uhlig (Ph.D. Thesis) Feb. 1966 159 p refs Prepared in Part by AEC
(Contract AT(40-1)-2504)
(TID-22822) CFSTI: HC $5.00/MF $1.50

The following K^- meson interactions in hydrogen were studied: $K^- + p \rightarrow \Lambda + \pi^0$, $K^- + p \rightarrow \Lambda + \pi^+ + \pi^-$, $K^- + p \rightarrow Y_1^{\pm}(1385) + \pi^{\mp}$, $K^- + p \rightarrow \Lambda + \pi^+ + \pi^- + \pi^0$, $K^- + p \rightarrow Y_0^*(1520) + \pi^0$, $K^- + p \rightarrow \Lambda + \eta$, $K^- + p \rightarrow K^0 + n$, and $K^- + p \rightarrow K^0 + p + \pi^-$ for incident K^- momenta between 900 and 990 Mev/c. Cross sections and angular distributions are presented and analyzed as a function of momentum. Results are interpreted in terms of the properties of the $Q^*(1765)$ resonance. Results are consistent with the existence of $Y^*(1765)$ with isotopic spin 1 and spin and parity $5/2^-$. Evidence is presented which shows that $\Lambda + \pi^0$, $Y_1^*(1385) + \pi$, $Y_0^*(1520) + \pi^0$, and $K^0 + n$ are all possible decay modes of the $Y^*(1765)$. Author (NSA)

N66-30910# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SCATTERING OF PARTICLES BY A SYSTEM OF FIXED CENTERS [RASSEYANIE POTOKA CHASTITS NA SISTEME ZAKREPLENNYKH TSENTROV]
I. Amirkhanov, V. F. Demin, B. N. Zakhar'ev, and I. I. Kuz'min 1966 10 p refs In RUSSIAN
(JINR-P-2554)

Scattering of particles by a system of fixed centers is considered. Domains of interaction of these centers with

incident particles do not intersect with each other. It is shown that the problem is reduced to solving a system of N algebraic equations ($N = n_1 \cdot n_2$; n_1 is the number of centers, n_2 is the number of the considered one-particle partial amplitudes). The scattering amplitude is expressed in terms of the partial scattering amplitudes on a single center. The formalism of multiple scattering is generalized to the case where the scattered particles are complex (can be excited)

Author (NSA)

N66-30911# California Univ., Berkeley. Lawrence Radiation Lab.

K^+ p INTERACTIONS AT 4.6 BEV/C

S. Goldhaber, J. L. Brown, I. Butterworth, G. Goldhaber, B. C. Shen et al 28 Feb. 1966 18 p refs Presented at the Intern. Conf. on Elementary Particles, Oxford

(Contract W-7405-ENG-48)

(UCRL-16332; CONF-650945-6) CFSTI: HC $1.00/MF $0.50

In a preliminary analysis of 50,000 photographs of the 80-inch BNL hydrogen bubble chamber exposed to a 4.6-Bev/c K^+ meson beam, the reactions were studied; $K^+ + p \rightarrow K^0\pi^+p$, $K^+p \rightarrow K^0\pi^+\pi^0p$, and $K^+ + p \rightarrow K^+\pi^-\pi^+p$. In all these reactions $K^*(1400)$ production is observed. The distribution of the $K\pi$ scattering angle for $K^*(1400)$ shows characteristic features expected for an aligned 2^+ meson on a one-pion-exchange model. The $K^*(890)\pi$ enhancement at 1320 Mev, reported by Almeida et al., is observed in reactions (2) and (3). A definite mass enhancement was for observed reactions (2) and (3) in the $C^*\pi$ mass spectrum at 1320 Mev with a width at about 80 Mev. This corresponds to the results reported by Almeida et al. The data were considered both as a bona fide resonance and a kinematical enhancement via the Deck mechanism.

Author (NSA)

N66-30912# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

CONTRIBUTION OF VIRTUAL COMPTON EFFECT TO THE CROSS SECTION FOR ELECTRON-POSITRON PAIR PRODUCTION [VKLAD VIRTUAL'NOGO KOMPTON-EFFEKTA V SECHENIE OBRAZOVANIYA ELEKTRON-POZITRONNYKH PAR]

V. I. Zhuravlev and L. D. Solov'ev 1966 9 p refs In RUSSIAN

(JINR-P-2602)

Using the data on ρ^0 meson photoproduction the contribution of strong interactions to the cross section for the leptonic pair photoproduction is estimated. This contribution is due to the virtual Compton effect in the energy range from 5 up to 20 BeV. Author (NSA)

N66-30913# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

ELASTIC pp-SCATTERING PHASE SHIFT AT 657 MeV WITH ACCOUNT OF ONE-BOSON EXCHANGE AND THE RELATIVISTIC COULOMB EFFECTS [FAZOVYI ANALIZ UPRUGOGO PP-RASSEYANIYA PRI 657 MEV S UCHETOM ODNOBOZONNOGO OBMENA I RELYATIVISTSKIKH KULONOVSKIKY EFFEKTOV]

L. S. Azhgirei 1966 7 p refs In RUSSIAN

(JINR-P-2585)

The phase shift analysis of the data on elastic pp-scattering was performed in the neighborhood of 660 MeV taking into consideration relativistic corrections in the Coulomb scattering. In calculating the phase shifts of higher states of pp-system account was also taken, besides the one-pion exchange, of the scalar and two vector bosons. The one-boson exchange turns out to be essential for describing data on small-angle proton polarization. Author (NSA)

N66-30914# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

DETERMINATION OF ONE-BOSON EXCHANGE MODEL PARAMETERS BY ELASTIC NUCLEON-NUCLEON SCATTERING PHASE SHIFTS [OPREDELENIE PARAMETROV ODNOBOZONNOI OBMENNOI MODELI PO FAZOVYM SDVIGAM UPRUGOGO NUKLON-NUCLONNOGO RASSEYANIYA]

L. S. Azhgirei and V. I. Chizhikov 1966 20 p refs In RUSSIAN

(JINR-P-2584)

The least squares method is used to determine one-boson exchange model parameters from the nucleon-nucleon phase shifts in the energy range of 25 to 310 Mev. Different methods for the explicit unitarization of the Born partial-wave amplitudes are compared. The K-matrix unitarization is shown to give the best fit to the pp-phase shifts. For an exchange of a scalar meson (σ), a pseudo-scalar meson (π), and two vector mesons (ω and ρ) a best fit to the NN-scattering was obtained with the following parameters: $g_\pi^2 = 2.9 \pm 0.4$; $m_\sigma = 373 \pm 13$ Mev; $g_\pi^2 = 13.1 \pm 0.2$; $g_\omega^2 = 2.1 \pm 0.5$; $f_\omega/g_\omega = 0.5 \pm 0.1$; $m_\omega = 422 \pm 18$ MeV, $g_\rho^2 = 0.1 \pm 0.3$; $f_\rho/g_\rho = -5.4 \pm 7.0$; $m_\rho = 800 \pm 120$ MeV. The energy dependencies calculated by the above parameters are compared with the results of phase shift analyses at 435 and 657 MeV. Author (NSA)

N66-30917# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

MASS FORMULA IN THE INHOMOGENEOUS SU(6,6) GROUP [MASSOVYE FORMULY V NEODNORODNOI GRUPPE SU(6,6)]

A. V. Nikolov and I. T. Todorov 1966 17 p refs In RUSSIAN

(JINR-P-2606)

A symmetry breaking for the inhomogeneous SU(6,6) group is introduced in the following way: it is required that the commutators of the 143-momentum P with isospin and hypercharge give zero when acting on physical states. Using this and the invariance of TrP^2, quadratic mass formulas are obtained both for mesons and baryons. For the mesons the obtained relations are satisfied within an accuracy greater than 1%. The agreement of the mass formulas for baryons with experiment is not so good. Author (NSA)

N66-30918# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

SUM RULES FOR PHOTON ABSORPTION BY NUCLEONS AND NUCLEON DIMENSIONS IN THE QUARK MODEL [PRAVILA SUMM DLYA POGLOSHCHENIYA FOTONOV NUKLONNAMI I RAZMERY NUKLONA V MODELI KUARKOV]

S. B. Gerasimov 1966 7 p refs In RUSSIAN

(JINR-P-2619)

The relation was obtained between the sum rules for electric dipole and quadrupole absorption with the charge distribution parameters of the proton. A strong difference of the quadrupole sum rule from experiment indicates that the quarks have their own electromagnetic structure.

Author (NSA)

N66-30919# Joint Inst. for Nuclear Research, Dubna (USSR).

ISOSPIN CONSERVATION AND POLARIZATION EFFECTS [SOKHRANENIE IZOSPINA I POLYARIZATSIONNYE EFFEKTY]

S. M. Bilen'kii, L. I. Lapidus, R. M. Ryndin, and L. Sh. Shekhter 1966 9 p refs In RUSSIAN

(JINR-P-2620)

The reactions $a + a' \rightarrow b + b'$ are treated in which the particles a and a' (or b and b') belong to the same isotopic

multiplet. As to the total isotopic sping of finite (or initial) particles, it may take only one value. Relations were obtained between polarization characteristics of such reactions at the angle θ and $\pi - \theta$ (θ is the c.m.s. angle). These relations are based only on isotopic invariance and invariance under rotations and reflections. Their experimental verification would be a detailed test of isotopic invariance of strong interactions. Author (NSA)

N66-30921# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
A MODEL OF WEAK INTERACTIONS OF BARYONS AND LEPTONS [MODEL SLABYKH VZAIMODEISTVII BARIONOV I LEPTONOV]
B. A. Arbuzov and A. T. Filippov 1966 20 p refs In RUSSIAN
(JINR-P-2578)

The model is considered, in which weak interactions of the two fundamental fields describing baryons and leptons are due to the change of space-time structure at small distances. The universality of weak interactions in the Cabibbo form, the selection rule $|\Delta S| \leq 1$ for all decays and the rule $\Delta S = \Delta Q$ for leptonic decays of hadrons follow from the main assumptions of the model. Author (NSA)

N66-30922# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON SYMMETRIES OF LEPTONS AND HADRONS IN WEAK INTERACTIONS. I: LEPTONS [O SIMMETRIYAKH LEPTONOV I ADRONOV V SLABYKH VZAIMODEISTVIYAKH. I. LEPTONY]
V. G. Kadyshevskii 1966 26 p refs In RUSSIAN
(JINR-P-2562)

A classification of leptons is suggested on the basis of the group O(5). Operators of electromagnetic and weak currents and the interaction lagrangians are constructed. Author (NSA)

N66-30923# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON AN APPLICATION OF THE "MAXIMUM COMPLEXITY" METHOD FOR DETERMINING SPINS AND PARITIES IN REACTIONS WITH POLARIZED PARTICLES [O PRIMENENII METODA "MAKSIMAL'NOI SLOZHNOSTI" DLYA OPREDELENIYA SPINOV I CHETNOSTEI V REAKTSIYAKH S POLYARIZOVANNYMI CHASTITSAMI]
S. M. Bilen'kii and R. M. Ryndin 1966 14 p refs In RUSSIAN
(JINR-P-2576)

A possible method is suggested to determine spins and intrinsic parities of particles produced in the reactions $0 + 1/2 \rightarrow J + S(J \rightarrow 0 + 0, S \rightarrow 1/2 + 0)$ and $\gamma + 0 \rightarrow j + 0(j \rightarrow 0 + 0)$ with polarized initial particles. The method is based on the requirement of invariance under reflections in the reaction plane (Bohr symmetry). The parity conservation in decays is not assumed. Author (NSA)

N66-30924# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
SOLVING THE PROBLEM OF TWO-PLANE WAVE SCATTERING IN THE NON-LINEAR SCALAR FIELD THEORY OF BORN-INFELD TYPE [RESHENIE ZADACHI O RASSEYANII DVUKH PLOSKIKH VOLN V NELINEINOI SKALYARNOI TEORII POLYA TIPA BORNA-INFEL'DA]
B. M. Barbashov and N. A. Chernikov 1966 16 p refs In RUSSIAN
(JINR-P-2603)

The scattering problem of two plane waves is formulated and solved in the classical nonlinear mesodynamics of the Born-Infeld type. The shape and direction of the plane waves after scattering turn out not to change. Only the arguments $x - t$ and $x + t$ are shifted by magnitudes determined by the momenta of these waves. The solution was obtained on the basis of the Cauchy problem for this equation. Author (NSA)

N66-30925# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
UNITARY SYMMETRY AND RESONANCE WIDTHS [UNITARNAYA SIMMETRIYA I SHIRINY REZONANSOV]
Nguyen Van Hien and F. F. Tikhonin 1966 15 p refs In RUSSIAN
(JINR-P-2568)

Under the assumption of exact unitary symmetry two-particle decays of baryon and meson resonances are treated. The ratios of resonance decay probabilities are given using relations between the coupling constants of particles obtained from SU(3) invariance and taking into account phase volumes. A comparison is made of the results obtained with the available experimental data. Author (NSA)

N66-30927# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
ON AN APPROXIMATE METHOD IN A TWO-NUCLEON PROBLEM [OB ODNOM PRIBLIZHENNOM METODE V ZADACHE DVUKH NUKLONOV]
V. N. Efimov 1966 17 p refs In RUSSIAN
(JINR-P-2546)

The application of the well-known Bubnov–Galerkin's method to solving integral equations is considered. Use is made of orthogonal polynomials with weight determined by the radial dependence of the potential. An approximate factorized expression was obtained for the t-matrix off the energy surface. The Yukawa potential is considered as an example. Author (NSA)

N66-30928# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
NEUTRINO PROCESSES [NEITRINNYE PROTSESSY]
I. M. Vasilevskii and L. I. Lapidus 1965 123 p refs In RUSSIAN
(JINR-P-2429)

An exposition of a course of lectures concerned with leptonic and semi-leptonic decays as well as with neutrino-induced processes is presented. The major part is devoted to theoretical and experimental works performed at high energy particle accelerators. A brief review is given of the modern theory of weak interactions of strange and non-strange particles. Results and techniques of neutrino experiments done at Brookhaven and CERN are presented. Future investigations with neutrinos are discussed. A possibility is discussed of checking basic features of current × current schome of weak interaction in investigating the conserved vector current at high values of energies and momentum transfers. Author (NSA)

N66-30929# Illinois Univ., Urbana. Dept. of Physics.
A STUDY OF THE $K^- + p \rightarrow \bar{K} + N + \pi$ REACTIONS AT 1.33 BeV/c
John Robert Ficenec (Ph.D. Thesis) Feb. 1966 131 p refs
(Contract AT(11-1)-1195)
(COO-1195-52) CFSTI: HC $4.00/MF $1.00

An experiment was performed on meson (K^-) proton interactions using the 72" Alvarez liquid hydrogen bubble chamber. As part of that experiment the University of Illinois group investigated the following topologies: 2-prong, 2-prong with 1 kink, and 0-prong with an associated vee. In particular, the reactions $K^- + p \rightarrow \bar{K} + N + \pi$ are reported. A sample of 30,000 frames containing 11,111 2-prong events was used, with measurements being done on SMP's. These reactions are found to be dominated by $\bar{K}^*(890)N$ production. Some evidence is also found for $N^*(1238)K$ and $Y_0^*(1520)\pi^0$ production, and slight amounts of $Y_1^*(1660)\pi$ and $Y_1^*(1765)\pi$ are seen. A backward peaking is seen to exist in the production angular distribution of the $K^{*-}(\bar{K}^0\pi^-)$. No evidence for this backward peaking is found in the other $\bar{K}N\pi$ final states. The production and decay angular distributions of the $\bar{K}^*(890)$ indicate that the $\bar{K}^{*0}n$ final state is produced predominantly by an exchange of a pseudoscalar meson of small mass, probably the pion. The $\bar{K}^{*-}p$ final states show less marked evidence for peripheral production than does the $\bar{K}^{*0}n$ final state. If the one-particle exchange model is hypothesized as a contributing mechanism, the $\bar{K}^{*-}p$ final states appear to have a large amount of T=0 vector meson exchange contributing to their production. This could be either the ω or ϕ meson.
Author (NSA)

N66-30933# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

AVERAGE COSINE OF THE SCATTERING ANGLE FOR PARTICLES IN A MAXWELLIAN GAS

B. Marsico, V. G. Molinari, and R. Scozzafava May 1965 19 p refs
(RT/FI(65)12)

An expression for the average cosine of the scattering angle of particles by a gas whose molecules are in motion with a Maxwellian distribution of velocities is derived. The assumption was made that the scattering is elastic and isotropic in the center of mass system. An application is given to the calculation of diffusion coefficient for thermal neutrons.
Author (NSA)

N66-30934# Comitato Nazionale per l'Energia Nucleare, Rome (Italy).

FLUX OF SLOW NEUTRONS AND GAMMA RAYS IN THE INTERIOR OF A PARAFFIN MODERATOR [FLUX DE NEUTRONS LENTS ET DE RAYONS GAMMA A L'INTERIEUR D'UN MODERATEUR DE PARAFFINE]

T. Trochev Oct. 1965 11 p refs In FRENCH
(RT-PROT-(65)32)

The evolution of the slow neutron and γ-ray flux during its passage through a phantom constituted by a block of paraffin was studied. The measurements made for the different forms of cavities indicate a larger dose than a moderator gives in other conditions. The evolution of the flux was characterized by a maximum at a depth of 2 cm. The flux maximum was always found at 2 cm of distance between two walls equivalent to the human tissue.
Author (NSA)

N66-30939# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.

PROCEEDINGS OF THE WORKING CONFERENCE ON INELASTIC SCATTERING OF SLOW NEUTRONS IN CRYSTALS AND LIQUIDS, JUNE 12-16, 1964, DUBNA [MATERIALY RABOCHEGO SOVESHCHANIYA PO NEUPRUGOMU RASSEYANNYU MEDLENNYKH NEITRONOV V KRISTALLAKH I ZHIDKOSTYAKH]

1965 68 p refs In RUSSIAN
(JINR-P-2081; CONF-640631)

Eighteen of the 35 papers presented at the conference on inelastic scattering of slow neutrons are compiled. Some of the papers are in abstract form only. Neutron scattering by molecules, magnetic scattering of neutrons, experimental methods, and the utilization of slow neutrons for the investigation of the dynamics of crystals and liquids were discussed.
NSA

N66-30941# India. Dept. of Atomic Energy, Bombay.

S4-B PROGRAM FOR SOLVING MULTI-GROUP TRANSPORT EQUATIONS WITH CARLSON'S S_4 APPROXIMATION

M. G. Bhide 1965 28 p refs
(AEET-210)

S4B program can solve multi-group Boltzmann equations in Carlson's S4 approximation and it is modified version of SNG code written for IBM-704 at Los Alamos by Carlson. It has additional options and special mathemstical routines to accelerate its convergence making it 3 times faster than diffusion theory codes like RE-101 of ANL, U.S.A. It can handle critical and noncritical systems (with or without multiplication of neutrons by fission process) in infinite plane slab, infinite cylinder and sphere geometries. Finite slabs and cylinders can also be considered by correcting transport cross sections with transverse bucklings varying with different regions and different energy groups. The second version (S4B II) has more options like reflective boundary condition on the outside (useful for making reactor lattice calculations, etc), and unsymmetric plane slab geometry. This code will help to derive many reactor parameters (e.g., lattice calculations) on a theoretical basis rather than on empirical basis which is a common practice at present.
Author (NSA)

N66-30948# India. Dept. of Atomic Energy, Bombay. Nuclear Physics Div.

EMISSION OF LONG RANGE ALPHA PARTICLES IN FISSION

T. Methasiri 1965 30 p refs
(AEET-235)

A survey of experimental and theoretical work on the emission of long range alpha particles in fission was made. Conclusions from this survey are presented.
NSA

N66-30949# Akademiya Nauk URSR, Kharkov. Fiziko-Tekhnicheskii Institut.

TWO-NUCLEON CORRELATIONS IN NUCLEI [DVUKHNUKLONNYE KORRELYATSII V YADRAKH]

A. G. Sitenko and I. V. Simenog 1965 31 p refs In RUSSIAN
(FTI-142/T-016)

The inelastic scattering of fast electrons on nuclei and the two-particle correlations in the nuclei were shown. The general relation between the inelastic scattering cross section and the two-particle correlation functions was established for nucleons in the nucleus. The spectral distributions of the two-particle correlation functions were calculated on the basis of the shell model. The two-fold magic nuclei ^4He, ^{16}O, and ^{40}Ca were examined as examples. The sum rule for correlation functions was established. The effect of the motion of inertia centers on the correlation functions was established using ^4He as an example.
Author (NSA)

N66-30950# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.

INVESTIGATION OF THE α-SPECTRUM OF Bi ISOTOPES [ISSLEDOVANIE α-SPEKTRA IZOTOPOV Bi]

I. Makhunka, L. Tron, T. Fenesh, and V. A. Khalkin 1966 8 p refs In RUSSIAN
(JINR-P-2553)

The α spectra of Bi isotopes formed by bombarding a lead target with 140-Mev protons were studied. Measurements were made using an α spectrometer with a semiconductor detector. The obtained half lives (T) and the α-particle energies were found. Author (NSA)

N66-30951# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Reactions.
STUDY OF NEUTRON PICKUP IN BOMBARDMENT OF Ta^{181}, Au^{197}, Th^{232}, U^{238} ISOTOPES WITH N^{15} IONS [IZUCHENIE REAKTSII PODKHVATA NEITRONA PRI OBLUCHENIE IZOTOPOV Ta^{181}, Au^{197}, Th^{232}, U^{238}IONAMI N^{15}]
A. G. Artyukh, V. V. Volkov, and T. Kvetsinska 1966 29 p refs In RUSSIAN
(JINR-P-2555)

The neutron pickup in the bombardment of ^{181}Ta, ^{197}Au, ^{232}Th, and ^{238}U with ^{15}N ions of 102-Mev energy was studied. The data on the angular distribution, effective reaction cross section and the energy spectrum of ^{16}N were obtained. It follows that the neutron transfer does not result in an appreciable excitation of the nucleus-target and that the deformation of the nucleus does not noticeably affect the neutron transfer. Author (NSA)

N66-30952# Kernforschungszentrum, Karlsruhe (West Germany)
THE WIDTH OF POTENTIAL BARRIER FOR SPONTANEOUS FISSION BY gg-NUCLEI [DIE DICKE DES POTENTIAL-WALLES FUER DIE SPONTANSPALTUNG BEI GG-KERNEN]
Hsi-chang Feng [1964] 5 p refs Transl. into GERMAN from Wu li Hsueh Pao (Peking), v. 20, no. 9, 1964 p 938–939 (KFK-TR-185) JCL: HC $1.00/MF $0.50

With the help of available experimental data on the spontaneous fission of gg-nuclei, calculations were made on the thickness of the potential wall for the isotopes ^{232}Th, ^{234}U, ^{236}U, ^{238}U, and ^{240}U. The results are tabulated and show that the width of the potential barrier decreases with increasing A. NSA

N66-30953# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
INELASTIC INTERACTION OF COSMIC-RAY PARTICLES WITH ATOMIC NUCLEI AT VERY HIGH ENERGIES [NEUPRUGIE VZAIMODEISTVIYA KOSMICHESKIKH CHASTITS S ATOMNYMI YADRAMI PRI OCHENY VYSOKIKH ENERGIYAKH]
I. Z. Artykov, V. S. Barashenkov, and S. M. Eliseev 1966 26 p refs In RUSSIAN
(JINR-P-2552)

It is shown that the generally accepted model of intranuclear cascades is not in agreement with experiment at T>>10 Bev, if in the calculations account is taken of the role of the leading particle carrying away 70% of the primary energy. To bring experiment and theory into agreement it is necessary to take into account many-particle interactions inside the nucleus. Author (NSA)

N66-30955# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ON THE EQUILIBRIUM DEFORMATIONS OF THE EXCITED STATES OF HEAVY NUCLEI [O RAVNOVESNYKH DEFORMATSIYAKH VOZBUZHDENNYKH SOSTOYANII TYAZHELYKH YADER]
Y. G. Solov'ev 1966 5 p refs In RUSSIAN
(JINR-P-2596)

It is investigated whether there exist excited states the equilibrium deformation of which differs from that of the ground state of the corresponding even nuclei. Some examples of such states in nuclei lying outside the transition region are given. Author (NSA)

N66-30956# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
INVESTIGATION OF NEUTRON RESONANCES OF Ho^{165} [ISSLEDOVANIE NEITRONNYKH REZONANSOV Ho^{165}]
E. N. Karzhavina, A. B. Popov, Yu. S. Yazitskii, V. N. Efimov, and N. Yu. Shirikova 1966 21 p refs In RUSSIAN
(JINR-P-2593)

The data are reported on the parameters of ^{165}Ho resonances obtained on a neutron spectrometer. An application of the shape analysis on a computer M-20 to obtain the resonance parameters is described. The parameters Γ and $g\Gamma_n$ were obtained for 17 levels in the range up to 110 eV, as well as the values of $g\Gamma_n$ for 50 levels in the region 110 to 500 eV. The found parameters are used to determine the strength functions $S_0 = (1.9 \pm 0.3) \cdot 10^{-4}$ and $\Gamma_\gamma = 73 \pm 3$ MeV.
Author (NSA)

N66-30957# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
INVESTIGATION OF Eu^{145} IRRADIATION [ISSLEDOVANIE ISLUCHENIYA EU^{145}]
I. Adam, K. Vil'skii, Zh. Zhelev, M. Iorgensen, M. Krivopustov et al 1966 19 p refs In RUSSIAN
(JINR-P-2581)

Conversion electron spectra, γ spectrum, $\beta^+\gamma$ spectra and that of e–γ coincidences were studied. The gamma-spectra was investigated by using the germanium semiconductor detector with a 1024-channel pulse height analyzer. A decay scheme $^{145}Eu \rightarrow {}^{145}Sm$ is suggested. Assumptions are made about the multipolarity of transitions, the level populations by electron capture are determined, and the values lg ft are calculated. Author (NSA)

N66-30958# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
ON THE DECAY CHAIN OF $Nd^{138} \rightarrow Pr^{138} \rightarrow Ce^{138}$ [O TSEPOCHKE RASPADA $Nd^{138} \rightarrow Pr^{138} \rightarrow Ce^{138}$]
K. Gromov, I. Demeter, and Zh. Zhelev 1966 16 p refs In RUSSIAN
(JINR-P-2570)

The more exact value of the ^{138}Nd isotope half life ($T_{1/2} = 5.2 \pm 0.1$h) was measured. The half life of the main state of $^{138}Pr(1^+)$ ($T_{1/2} = 1.5 \pm 0.15$ min) and the mass difference of the nuclides $^{138}Pr(1^+)$ and ^{138}Ce (Q = 4460 ± 40 kev) were found. The energy difference of the isomeric state of ^{138}Pr ($T_{1/2} = 2.1$h) and the main one ($\Delta E = 330 + 60$ kev) were determined. The values of lg ft for beta-transfer to the lower levels of ^{138}Ce from the $^{138}Pr(1^+)$ decay were calculated. The nature of the ^{138}Ce nucleus is discussed. Author (NSA)

N66-30959# International Centre for Theoretical Physics, Trieste (Italy).
ARE QUARKS FRACTIONALLY OR INTEGRALLY CHARGED?

M. P. Khanna and S. Okubo 31 Mar. 1966 9 p refs Submitted for Publication
(IC-66/28)

On the basis of algebra of currents, the decay rate $\pi^0 \rightarrow 2\gamma$ and the axial vector renormalization constant g_A were calculated. These numbers are model dependent, and it was found that the fractionally charged quark model gives more satisfactory results than the integrally charged quark model. Author (NSA)

N66-30960# International Centre for Theoretical Physics, Trieste (Italy).
COMPLETENESS, UNITARITY, AND DISPERSION RELATIONS IN POTENTIAL SCATTERING
I. Saavedra 5 Apr. 1966 10 p ref Submitted for Publication
(IC-66/29)

It is shown that the assumption of completeness of the set of scattering states implies the unitarity condition for the total scattering amplitude and dispersion relations for the S-matrix for each value of the angular momentum.
Author (NSA)

N66-30961# Tokyo Univ. (Japan). Inst. for Nuclear Study.
TABLE OF SINGULARITIES IN NUCLEAR DIRECT INTERACTION AMPLITUDE: p-SHELL NUCLEI—WITH SEVERAL REMARKS ON DIRECT INTERACTION MECHANISMS
Haruo Ui 1 Mar. 1966 60 p refs
(INSJ.96)

In order to see relative importance among different direct interaction mechanisms, locations of the leading singularities of the direct interaction amplitudes in q^2-as well as cos θ-planes are tabulated for the transfer (stripping or pick-up), knock-on, and heavy-particle-stripping reactions. The tables include the following twenty types of nuclear reactions, the (p,d), (p,t), (p,^{3}He), (p,α), (d,p), (d,t), (d,^{3}He), (d,α), (t,p), (t,d), (t,^{3}He), (t,α), (^{3}He,p), (^{3}He,d), (^{3}He,t), (^{3}He,α), (α,p), (α,d), (α,t) and (α,^{3}He) reactions, each from the ground states of O-p shell target nuclei of ^{6}Li, ^{7}Li, ^{9}Be, ^{10}B, ^{11}B, ^{12}C, ^{14}N, ^{15}N, and ^{16}O. By examining both qualitative and quantitative behaviors of the singularities, several remarks are added concerning the direct interaction mechanisms. In particular, it is pointed out that the heavy-particle-stripping mechanism will play the most important role in several cases such as the ^{9}Be(p,α)^{6}Li reaction at lower energy. Author (NSA)

N66-30969# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
NEUTRON FLUXES IN ANTIMONY-BERYLLIUM SYSTEMS
S. A. Kushneriuk, P. M. Attree, and J. M. Kennedy Nov. 1963 24 p refs Reprinted Mar. 1965
(TPI-104; AECL-2229) Available from Atomic Energy of Canada, Ltd., Chalk River: $1.00

Radioactive ^{124}Sb (half-life 60.4 days) disintegrates by the emission of β particles of various energies; the daughter nucleus, ^{124}Te is subsequently reduced to its ground state by emission of γ rays. In particular, 0.48 of the ^{124}Sb disintegrations yield a 1.692 Mev γ ray which has a relatively large cross section (1.35 mb) for the production of 25 kev neutrons in ^{9}Be via the γ-n interaction. Results are reported of calculations of the "thermal" neutron fluxes which develop in two types of antimony–beryllium systems: a radioactive antimony pellet contained in a beryllium blanket which is embedded in light water and radioactive antimony "pencils" embedded in a large block of beryllium. These results are intended to provide a basis for assessing the feasibility of using antimony–beryllium as sources of high thermal neutron fluxes. The threshold energy for the γ-n interaction in beryllium is 1.666 Mev. In the decay of ^{124}Sb, γ rays with energies greater than the 1.692 Mev mentioned above are also emitted. However, their contribution to the neutron production in beryllium is small and in the calculations, this production via the 1.692 Mev γ ray neutron production was included by increasing the fraction of the disintegrations which yield a 25 kev neutron to 0.50. Neutron fluxes are calculated by means of two-group diffusion theory.
Author (NSA)

N66-30973# California Univ., Livermore. Lawrence Radiation Lab.
FIELD THEORY OF THE TWO-PION SYSTEM (S AND D WAVES)
Moorad Alexanian and Marcel Wellner (Syracuse Univ.) [1965] 38 p refs Submitted for Publication
(UCRL-14496-T)

Use is made of a recently developed series expansion, applying the procedure to S and D waves. With an input of (π mass) = 1, (ρ mass) = 5.53, the results for the isospin-T, spin-J scattering lengths a_J^T and the Chew-Mandelstam coupling constant λ are: $a_0^0 = -0.72$, $a_0^2 = -0.40$, $a_1^1 = +0.032$, $a_2^0 = +0.0032$, $a^2 = 0.0026$, and $\lambda = +0.22$. The results for a_2^{02} and λ are improved by a higher order correction, but with little change from previous work; a_1^1 is as quoted previously, the a_2^{02} are new results. The S-wave phase shifts δ_0^T are also calculated and it is found that δ_0^0 and δ_0^2 go through $-1/2\pi$ on the way down at energies of 760 and 630 Mev, respectively. Finally the D-wave phase shifts are calculated: The f^0 resonance is found at 1950 Mev, and a corresponding T = 2, D-wave resonance is found at 1520 Mev. The substantial discrepancy with experiment for the f_0 is attributed to the need for considering more terms in the expansion as energy increases, as well as to a diminished reliability of the $\lambda\phi^4$ model at high energy.
Author (NSA)

N66-30974# California Univ., Livermore. Lawrence Radiation Lab.
UNDERGROUND NEUTRINO EXPERIMENT. INVERSE BETA DECAY
S. A. Colgate Jul. 1965 6 p
(Contract W-7405-ENG-48)
(UCRL-12085, Pt. I) CFSTI: HC $1.00/MF $0.50

An experiment is outlined to observe the inverse β-decay reaction as a preliminary step in the measurement of the electron-neutrino scattering cross section. It is proposed to detect the neutrinos from the superallowed β-decays of fission fragments produced in an underground nuclear detonation, by means of a disposable Cd-loaded scintillator 1 m^3 in volume. The detector will be located as close to the nuclear device as possible (~100 ft) to take advantage of solid angle gains. Estimates are given for the neutrino detection probability as a function of time. Author (NSA)

N66-30975# California Univ., Livermore. Lawrence Radiation Lab.
UNDERGROUND NEUTRINO EXPERIMENT. II: NEUTRINO-ELECTRON SCATTERING
S. A. Colgate Jul. 1965 5 p refs
(Contract W-7405-ENG-48)
(UCRL-12085, Pt. II) CFSTI: HC $1.00/MF $0.50

A discussion is presented on possible neutrino sources and detection systems for the observation of the inverse

β-decay reaction. Arguments based on the dependence of detector efficiency on energy and the value of the scattering cross section on type of electron suggest the use of the super-allowed decay of ^{12}N as the neutrino source. Considerations of the needed mass of detector and allowed detection time indicate the use of liquid scintillators or bubble chambers as detection systems. The relative merits of these systems are discussed. Author (NSA)

N66-30976# Florida Univ., Gainesville. Dept. of Chemical Engineering.

EXPERIMENTAL EFFECTS OF PILE RADIATION ON PURE FLUOROCARBONS Final Report

T. M. Reed, J. C. Mailen, and W. C. Askew 14 Sep. 1965 11 p refs

(Contract AT(40-1)-2846)

(TID-22421) CFSTI: HC $4.00/MF $0.75

Samples of pure fluorocarbons were irradiated and then analyzed by three-column gas chromatography. Mixtures of CF_4–C_2F_6 CF_4 with CO, carbon granules, and aluminum powder were also irradiated. The total G values for the destruction of F-alkanes were considerably less than those of the analogous hydrocarbons, especially for the lower members, CF_4, F_2F_6, and C_3F_8. An exception is the highly branched structure, F-2,3-dimethylbutane, which has a G_{total} of magnitude similar to those of the hydrocarbon alkanes. The primary reason for this difference from hydrocarbons is the low probability for fluorine abstraction reaction due to the low energy of dissociation of the fluorine molecule. All of the identified products of the radiolysis of the CF_4–C_2F_6 mixtures are explained by a free radical mechanism. Data are tabulated. NSA

N66-30979 California Univ., Berkeley. Lawrence Radiation Lab.

CALCULATION OF THE INFRARED ACTIVE BENDING DIPOLE DERIVATIVE AND FORCE CONSTANT METHANE

Robert N. Kortzeborn (Ph.D. Thesis) Nov. 1965 89 p refs

(Contract W-7405-ENG-48)

(UCRL-16265) CFSTI: HC $3.00/MF $0.75

The dipole derivative and bending force constant are calculated for an infrared active vibration of methane via the one-center electronic self-consistent-field method. The one-center spherical model Hartree–Fock self-consistent-field analytical electronic wavefunction (OCSMHFSCF) of methane is calculated by retaining only terms of $l=0$ in the nuclear-electronic potential term of the Hamiltonian. The force constant is calculated with this function by variation-perturbation techniques. An improved non-spherical SCF function containing terms of 1 up to and including three is then used to recalculate the force constant and dipole derivative. The best calculated force constant is in error by only 2% while the dipole derivative is approximately twice the observed value. This enables the influence of higher symmetry terms on the force constant to be tested, and the usefulness of the dipole derivative and force constant for determining the quality of molecular wavefunctions of this type to be analyzed. Author (NSA)

N66-30984# Joint Inst. for Nuclear Research, Dubna (USSR).

ON FLUCTUATIONS OF IONIZATION LOSSES [O FLYUKTUATSIYAKH IONIZATSIONNYKH POTER]

B. M. Golovin, L. A. Kulyukina, S. V. Medved, P. Pavlovich, and P. Shulek 1966 7 p refs In RUSSIAN

(JINR-P-2615)

The formula for the ionization loss distribution in thin layers obtained earlier by P. V. Vavilov is made more accurate by taking into account the charged particle collisions with electrons bound in the atoms of the stopping materials. Author (NSA)

N66-30989# California Univ., Berkeley. Lawrence Radiation Lab.

SECONDARY ELECTRON DISTRIBUTION FOR HEAVY IONS

Nobuo Oda and John T. Lyman 15 Sep. 1965 21 p refs Presented at the Workshop Conf. on Space Radiation Biol., Berkeley, Calif.

(Contract W-7405-ENG-48)

(UCRL-16405; CONF-650924-6) CFSTI: HC $1.00/MF $0.50

Two approaches for examining the contribution of delta rays to the radiation effect of heavy ions are discussed. They are the space-averaged picture and the extended-track picture. The fundamental quantity for the space-averaged picture is the differential flux ϕ_δ (E) of δ rays. Experimental results on the low-energy part of ϕ_δ (E) are presented. NSA

N66-30992# Maryland Univ., College Park. Dept. of Physics and Astronomy.

THREE-PARTICLE UNITARITY INTEGRAL Technical Report No. 454

Ming Chiang Li Apr. 1965 62 p refs

(Contract AT(40-1)-2504)

(TID-22274) CFSTI: HC $3.00/MF $0.75

The partial wave decomposition of the three-particle unitarity condition is studied. Using simple Feynman amplitude as an illustration, two three-particle unitarity integrals are constructed (cross and non-crossed integrals). The partial-wave amplitudes and their energy dependence for these two cases are investigated. It is shown that the contribution from the non-crossed integral decreases faster than that from the crossed integral as the angular momentum increases. The effects of the unstable-particle width on the effective two-particle approximation of the three-particle unitarity integral are examined. Author (NSA)

N66-30993# Rochester Univ., N. Y. Dept. of Physics and Astronomy.

MEASUREMENTS OF POSITIVE KAON PRODUCTION IN PROTON–PROTON COLLISIONS AT 2.85 AND 2.40 BeV

James Theodore Reed (Ph.D. Thesis) [1965] 146 p refs

(Contract AT(30-1)-875)

(TID-22315) CFSTI: HC $4.00/MF $0.75

An experiment is described in which protons from the external beam of the BNL Cosmotron were directed onto a liquid hydrogen target, and the doubly differential cross sections $d^2\sigma/d\Omega dp$ for the production of positive kaons were measured. These measurements were made at incident proton kinetic energies of 2.85 and 2.40 Bev and at laboratory angles of 0°, 17°, and 32°. The kaon data are presented in the form of five laboratory and five center-of-mass spectra. The results of integrating these spectra over momentum are given, i.e., $d\sigma/d\Omega$. A further integration over angles yields a total cross section for production of K^+ of $\sigma=279\pm56$ μ barns. An enhancement is seen in the 0° spectra, at or near the maximum kaon momentum. Possible explanations for the peak are advanced in terms of a lambda–proton bound state, resonance, and final state interaction. The possibility of a bound state is shown to be unlikely. The peak would correspond to a Q value of 4 ± 8 Mev/c^2 for the $\Lambda-p$ system. From a Breit-Wigner fit, one finds $\Gamma/2 = 17^{+\infty}_{+10}$. Using the S-wave scattering formalism, the peak can be fitted by "a" $= +3 \pm 1$f and "r_0" ≤ 2f. Author (NSA)

N66-30998# Iowa State Univ. of Science and Technology, Ames. Ames Lab.

FLASH DESORPTION AND ISOTOPIC MIXING OF SIMPLE DIATOMIC GASES ON TUNGSTEN, IRIDIUM AND RHODIUM

Victor Joseph Mimeault (Ph.D. Thesis) Feb. 1966 204 p refs (Contract W-7405-ENG-82)
(IS-T-67) CFSTI: HC $6.00/MF $0.25

Flash desorption of H_2, N_2, and CO from W, Ir, and Rh dosed at 100 and 300°K was investigated together with isotope mixing in co-adsorbed mixtures of H_2-D_2 and $^{14}N_2-^{15}N_2$. The desorption spectrometer was constructed so that the ultimate pressure was less than 5×10^{-10} torr, the pressure and temperature could be measured simultaneously during an experiment and the desorption products identified mass spectrometrically. The desorption of H_2 from W, Ir, and Rh dosed at 300°K proceeds by a second order process with an activation energy of desorption which has the the form, $\Delta H=\Delta H_0-\alpha n$. At low surface coverages, a value of 35, 24, and 18 kcal/mole respectively was obtained for ΔH_0; the parameter α was determined from desorption curves at higher initial surface coverages and was found to be 28±2, 14±1, and 24±2 cal/mole/10^{12} molecules/cm^2 respectively. The isotopes in the desorbed phase formed from dosing these metals at 300°K with a mixture of H_2 and D_2 are statistically distributed, whereas the ambient distribution is clearly nonstatistical. The desorption spectrum of H_2 from these metals dosed at 100°K contains two peaks, α and β. The distribution of the isotopes in the desorbed phase formed from co-adsorbing H_2 and D_2 indicates that the α-peak is due to an atomic species in the case of Ir and Rh and a molecular species in the case of W. Desorption of N_2 from W dosed at 300°K, contains two peaks, α and β. The α-peak was kinetically first order and the β, second order with activation energies of 20 and 75 kcal/mole respectively. When W was dosed with a mixture of $^{14}N_2$ and $^{15}N_2$, the α-peak was devoid of $^{14}N^{15}N$ whereas the β-peak was completely isotopically mixed on desorption. The amount of N_2 adsorbed on Ir and Rh was a function of the temperature of the filament in the ion gauge. A model is presented to account for the observed adsorption of N_2 on Ir and Rh. The desroption spectrum of CO from Ir and Rh contains only one peak which desorbs over the range 450–750°K. From the equal amounts of CO and H_2 adsorbed, it is inferred that the desorption peak is due to the bridged–bonded form of CO. Author (NSA)

N66-30999# Kernforschungszentrum, Karlsruhe (West Germany).

EXPERIMENTAL STUDY OF THE NEUTRON THERMALIZATION PROCESS IN TIME IN GRAPHITE AND BERYLLIUM [EXPERIMENTELLE UNTERSUCHUNG DES ZEITVERLAUFS DER NEUTRONENTHERMALISIERUNG IN GRAPHIT UND BERYLLIUM]

V. I. Mostovoi, I. P. Sadikov, A. A. Chernyshov, S. N. Ishmaev, M. S. Yudkevich et al 1965 25 p refs Transl. into GERMAN from the Russian Rept.-IAE-850
(KFK-TR-188)

A research installation for the study of standardization of the equilibrium energy spectrum of neutrons in various medium was described. With a high flux electron linear accelerator short pulses of fast neutrons were produced in the moderators investigated. The neutron spectra in the beam emitted by the moderator were measured at various times after the fast neutron pulse with a mechanical chopper working in synchronous operation with the accelerator. The best resolution in the spectral measurement is 2.5 μsec/m and the minimum uncertainty in the slowing-down time is 3.5 μsec. The measurement results of the nonstationary spectra in graphite ($B^2 = 8.9\times10^{-3}$ cm^{-2} and in beryllium ($B^2 = 9.7\times10^{-3}$, 24×10^{-3}, and 43×10^{-3} cm^{-2}) was given for slowing down times from 30 μsec up to 2500 μsec. The measurement results in beryllium were compared with calculated nonstationary spectra obtained from double differential cross sections after these had been calculated from the experimental values for the energy spectrum of the lattice oscillations of beryllium. The chemical compound and the thermal motion of the atoms of the moderator exert even at times of approximately 30 μsec a remarkable effect on the velocity of the approach of the neutron spectrum to the equilibrium spectrum. This corresponds to a mean spectrum energy of approximately 1 ev for graphite and approximately 0.2 ev for beryllium. The total time necessary for the attainment of the equilibrium spectrum of the neutrons is approximately 2000 μsec in graphite and approximately 1000 μsec in beryllium. The formation of neutron spectra in small beryllium blocks was determined to a great degree by the coherent scattering which leads to the formation of the so called neutron drop, which delays the process of the attainment of the equilibrium spectra. Author (NSA)

N66-31002# Brookhaven National Lab., Upton, N. Y.

PRODUCTION OF ^{52}Fe

M. W. Greene and Manny Hillman 3 May 1965 10 p refs
(Contract AT(30-2)-GEN-16)
(BNL-9168) CFSTI: HC $1.00/MF $0.50

Millicurie quantities of ^{52}Fe were produced by the ^{50}Cr $(\alpha,2n)^{52}$Fe reaction using enriched ^{50}Cr as Cr_2O_3, which was recovered for re-use. Author (NSA)

N66-31004# Gosudarstvennyi Komitet po Ispol'zovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.

STUDY OF TRANSIENT NEUTRON SPECTRA IN ZIRCONIUM HYDRIDE [INUCHENIE NESTATSIONARNYKH SPEKTROV NEITRONOV V GIDRIDE TSIRKONIYA]

S. N. Ishmaev, V. I. Mostovoi, V. Z. Nozik, I. P. Sadikov, A. A. Chernyshov et al 1965 16 p refs In RUSSIAN
(IAE-977)

The results of the experimental and theoretical study of the transient thermal neutron processes in zirconium hydride $ZrH_{1.88}$ were reported. The time dependent neutron spectra were measured in $ZrH_{1.88}$ prisms with resolutions of 3.5 μsec according to the delay time. In the time delay range studied ($T > 30$ μsec) the mean energy of the neutrons had a lower energy of the first optical leval of the zirconium hydride (0.13 ev) and there was energy exchange between the neutron gases and the medium caused by the excitation of the acoustical oscillation of the $ZrH_{1.88}$ lattice. The time necessary for the establishment of the equilibrium spectra in the "big" system ($B^2 = 3.8\times10^{-2}$ cm^{-2}) appeared to be of the order of 400 μsec. In the $ZrH_{1.88}$ system of "small" dimensions ($B^2 = 0.2$ cm^{-2}) a strong effect of the diffusing of the spectrum was observed and the time necessary for the establishment of the equilibrium energy distribution increased with decreased dimensions of the system. The results of the calculation of the non-stationary neutron spectrum in the P-1 approximation were reported. The two fold differential cross sections of $ZrH_{1.88}$ necessary for these calculations were obtained by use of the spectrum of the normal oscillations of hydrogen atoms in the Zr lattice. The best agreement of measured neutron spectrum with the calculations was obtained if it was assumed that the amplitude of the acoustical and optical oscillations in $ZrH_{1.88}$ had the ratio 1/360. Author (NSA)

N66-31008# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

A DIFFERENCE SIGN OF REAL PARTS OF ELASTIC $\pi^{\pm}$-P SCATTERING AMPLITUDES AT VERY HIGH ENERGIES [ZNAK RAZHOSTI REAL'NYKH CHASTEI AMPLITUD UPRUGOGO $\pi^{\pm}$-P RAS SEAYNIYA V OBLASTI OCHEN VYSOKIKH ENERGII]

V. S. Barashenkov and N. F. Truskova 1966 7 p refs In RUSSIAN
(JINR-P-2566)

It is shown that by using dispersion relations it is not possible to fit the experimental data on the zero-angle $\pi^{\pm}$p charge exchange cross section and the energy dependence of the total $\pi^{\pm}$p interaction cross section at T≈5 to 20 Bev, on the one hand, and the results of measurements of the real parts of the elastic $\pi^{\pm}$p scattering amplitudes, on the other. Author (NSA)

N66-31009# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

A METHOD FOR SOLVING THE NUCLEON-PHONON INTERACTION PROBLEM [ODIN METOD RESHENIYA ZADACHI NUKLON-FONONNOGO VZAIMODEISTVIYA]

I. N. Mikhailov and R. V. Dzholov 1966 18 p refs In RUSSIAN
(JINR-P-2567)

A method to solve the Schroedinger equation for fermions interacting with phonons in a system with sufficiently small number of fermion states is suggested. The method is described by an example of a problem with a scalar phonon coupling the orbitals of two degenerate fermion energy levels. The solution of the Schroedinger equation is achieved by finding the integrals given by entire functions of the two coupled differential equations. Author (NSA)

N66-31010# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.

ON SPIN TEST FOR BOSONS DECAYING INTO THREE SPINLESS PARTICLES [OB OPREDELENII SPINA BOZONOV, RASPADAYUSHCHIKHSYA NA TRI BESSPINOVYE CHASTITSY]

R. M. Ryndin 1966 6 p refs In RUSSIAN
(JINR-P-2577)

A possible method is suggested to determine the spin of bosons produced in the reactions of the type 0+0→S+0 and decaying into three spinless particles. It is shown that the coefficient for the highest Legendre polynomial in the angular correlation between the normals to the production and decay planes cannot vanish and is restricted by the absolute magnitude. Author (NSA)

N66-31011# Joint Inst. for Nuclear Research, Dubna (USSR).

ON A POSSIBLE APPLICATION OF A NUCLEAR REACTION IN CHEMICAL RESEARCH [O VOZMOZHNOSTI PRIMENENIYA ODNOI YADERNOI REAKTSII V KHIMICHESKIKH ISSLEDOVANIYAKH]

V. I. Petrukhin, L. I. Ponomarev, Yu. D. Prokoshkin 1966 6 p refs In RUSSIAN
(JINR-P-2558)

The possibility of distinguishing between chemically bound and free hydrogen by using nuclear charge exchange of the stopping negative pion on the proton is reported. Author (NSA)

N66-31017# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.

ANALYSIS AND GENERALIZATION OF CORRELATION METHOD FOR MEASUREMENT OF PARTICLE-LIFETIME DISTRIBUTION IN PHYSICAL SYSTEMS [ANALIZ I OBOBSHCHENIE KORRELYATSIONNOGO METODA IZMERENIYA RASPREDELENIYA VREMENI ZHIZNI CHASTITS V FISICHESKOI SISTEME]

V. G. Zolotukhin, A. A. Kutuzov, D. L. Broder, L. P. Kham'yanov, B. A. Efimenko et al 1965 12 p refs In RUSSIAN
(FEI-21)

A complete statistical analysis was given of the correlation method for the measurement of the distribution of particle lifetimes in linear physical systems. It was shown that the correlation method has significant advantages with respect to the current method of periodic pulse excitation in cases where the measurement is accompanied by high background. A new type of pseudo-random modulation of the particle source was suggested. Author (NSA)

N66-31019# Brookhaven National Lab., Upton, N. Y.

NUMERICAL ANALYSES OF NEUTRON RESONANCES BY USE OF COMPUTER PROGRAMS

M. R. Bhat, R. E. Chrien, and I. W. Cole [1966] 16 p refs Presented at the Am. Phys. Soc. Conf. on Neutron Cross Section Technol., Washington, 22-24 Mar. 1966
(Contract AT(30-2)-GEN-16)
(BNL-10094; CONF-660303-12) CFSTI: HC $1.00/MF $0.50

The use of computer-oriented, automated techniques in the analysis of slow neutron cross sections is described, with special emphasis on the measurement of neutron resonance parameters. The application of these techniques is illustrated at each stage of the data reduction process. A description of the determination of the resolution function for the BNL chopper time-of-flight system is given. The results of resonance analysis with a non-Gaussian resolution function are presented. Author (NSA)

N66-31020# European Organization for Nuclear Research, Geneva (Switzerland).

MEASUREMENT OF POLARIZATION PARAMETERS AND SPIN CORRELATION IN PROTON-PROTON SCATTERING AT 600 MeV BY MEANS OF A TARGET OF POLARIZED PROTONS [MEZURE DES PARAMETRES DE POLARISATION ET DE CORRELATION DE SPIN DANS LA DIFFUSION PROTON-PROTON A 600 MEV A L'AIDE D'UNE CIBLE DE PROTONS POLARISES]

G. Coignet 19 Jan. 1966 65 p refs In FRENCH
(CERN-66-2)

The general formalism of proton-proton scattering and its relation to different experiments is reviewed. The experiments are also compared to those made without a polarized target. The beam, the polarized proton target, and the experimental detection installation used are described. A beam of protons capable of easily being transformed into a polarized beam with intensity and polarization sufficient for experimentation was constructed. The beam made it possible to evaluate the analysis capacity of carbon at 575 Mev at 4 angles. By the use of this beam with a target of polarized protons the angular distribution of the parameters of polarization P^0 and of correlation C_{NN} was measured in proton-proton scattering at 600 Mev. NSA

N66-31021# Oak Ridge National Lab., Tenn.
METHOD FOR OBTAINING BURSTS OF POLARIZED NEUTRONS WITH ENERGIES 10–700 KeV
J. W. T. Dabbs and J. A. Harvey [1965] 6 p refs Presented at the Intern. Conf. on Polarization Phenomena of Nucleons, Karlsruhe, West Germany
(Contract W-7405-ENG-26)
(ORNL-P-1604; CONF-650928-6) CFSTI: HC $1.00/MF $0.50

The polarization of fast neutrons by scattering on a one cm layer of liquid helium is discussed. A survey of possible moderators which could be expected not to depolarize the beam was made. Estimated intensities for both graphite and water moderators are given, as obtained from a Monte Carlo calculation. NSA

N66-31030# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Experimentelle Kernphysik.
LARGE AREA SCINTILLATION COUNTER WITH POSITION INDEPENDENT LIGHT YIELD AND ITS USE AS A VIEWING COUNTER [GROSSFLAECHIGER SZINTILLATIONSCAEHLER MIT ORTSUNABHAENGIGER LICHTAUSBEUTE UND SEINE BENUTZUNG ALS SCHAUERZAEHLER]
J. Goerres Dec. 1955 12 p refs In GERMAN
(KFK-388)

A large-area viewing counter (61 cm×61 cm) was constructed for the separation of electrons from pions. The exciting pulses were independent of the site of origin. The construction of the counter is described, and its resolution and homogeneity of the light collection are discussed. NSA

N66-31044# Osterreichische Studiengesellschaft für Atomenergie G.m.b.H., Seibersdorf (Austria).
MEASUREMENT OF THE SURFACE CONTAMINATION OF COATED PARTICLES BY FISSIONABLE MATERIAL [MESSUNG DER OBERFLAECHENVERUNREINIGUNG VON BESCHICHTETEN TEILCHEN DURCH SPALTBARES MATERIAL]
K. H. Buchner and P. Koss 1966 25 p refs In GERMAN
(SGAE-M-4/1966)

The surface contamination of coated particles was determined by measurement by the α radiation of the particle surface and by measurement of fission products arising by fission recoil from surface. The results of the two methods were compared, and the fission product method was found to be superior to the α measurement method. NSA

N66-31049# Kernforschungsanlage, Juelich (West Germany). Inst. für Physikalische Chemie.
DETERMINATION OF SPECIFIC α ACTIVITY OF ^{239}Pu WITH THE HELP OF A LIQUID SCINTILLATION COUNTER METHOD [BESTIMMUNG DER SPEZIFISCHEN α-AKTIVITAET DES ^{239}Pu MIT HILFE EINER FLUESSIG-SZINTILLATIONSZAEHLMETHODE]
H. R. Ihle, M. Karayannis, and A. P. Murrenhoff Jan. 1966 36 p refs In GERMAN; ENGLISH Summary
(JUL-347-PC)

By using an improved liquid scintillation counting method, the specific α-activity of Pu-239 was determined to be $136400 \pm 360\ dpm^{-1}/ug^{-1}$, which corresponds to a half life of 24350 ± 63 years. The counting method used has considerable advantages over other methods for the precise determination of specific activities of α-emitters. However, the possibilities of discriminating against β/γ-emitting impurities are limited.
Author (NSA)

N66-31063# Atomic Energy Information Service, Frankfurt am Main (West Germany).
HIGH-ENERGY PHYSICS. SERIES C: BIBLIOGRAPHIES, PART 1
K. Mellentin and I. Vierk, comp. Aug. 1965 266 p refs
(AED-C-23-08, Pt. 1)

Approximately 4,000 articles dealing with all aspects of high-energy physics are listed. Author and report number indexes are included. NSA

N66-31064# Atomic Energy Information Service, Frankfurt am Main (West Germany).
HIGH-ENERGY PHYSICS. SERIES C: BIBLIOGRAPHIES, PART 2
K. Mellentin and I. Vierk, comp. Aug. 1965 284 p refs
(AED-C-23-08, Pt. 2)

A bibliography on high energy physics is presented. The references are indexed alphabetically by author and include corporate source and report number. R.N.A.

N66-31068# Massachusetts Inst. of Tech., Cambridge. Lab. for Nuclear Science.
CORRELATION ENHANCEMENT OF COMPOUND ELASTIC SCATTERING AND DOORWAY STATE REACTIONS
P. A. Moldauer 27 May 1965 9 p refs Prepared in cooperation with Argonne Natl. Lab.
(Contract AT(30-1)-2098)
(MIT-2098-149) CFSTI: HC $1.00/MF $0.50

The effects of width correlations on the energy averages of fluctuating cross sections were earlier discussed with respect to compound elastic scattering. It is pointed out that such correlations may also produce a substantial enhancement of average non-elastic reaction cross sections. A quantitative discussion is given of the correlation enhancement of both composed elastic and doorway state reaction cross sections. NSA

N66-31069# Los Alamos Scientific Lab., N. Mex.
THE FISSION CROSS SECTION OF U^{233}, 20eV TO 2MeV
D. W. Bergen, M. G. Silbert, and R. C. Perisho 1966 13 p refs Presented at Am. Phys. Soc. Conf. of Neutron Cross Section Technol., Washington, D. C., 22–24 Mar. 1966
(Contract W-7405-ENG-36)
(LA-DC-7622; Conf-660303-16 CFSTI: HC $1.00/MF $0.50

Data are presented on the fission cross section of U^{233} over the energy range from 20 ev to 2 Mev. These data were obtained in June 1965 by exposing a thin target of U^{233} to neutrons originating from an underground nuclear detonation. The data show resolved individual resonances from 20 ev to about 100 ev and resonance structure to above 1 kev. The low background and good energy resolution inherent in this experiment provide an improved peak-to-valley ratio compared to previously reported data. Author (NSA)

N66-31071# Los Alamos Scientific Lab., N. Mex.
FISSION CROSS SECTION OF PU^{239}, 20 eV TO 2 MeV
Edward R. Shunk, W. K. Brown, and R. La Bauve 1966 16 p refs Presented at Am. Phys. Soc. Conf. of Neutron Cross Section Technol., Washington, D. C., 22–24 Mar. 1966
(Contract W-7405-ENG-36)
(LA-DC-7620; CONF-660303-22) CFSTI: HC $1.00/MF $0.50

The fission cross section of ^{239}Pu was measured by time-of-flight using neutrons from an underground nuclear explosion. The Petrel event in June 1965, at the Nevada

Test Site provided an extremely high neutron flux from 20 eV to 2 MeV. The neutron flux was determined from simultaneous measurement of $^6Li(n,\alpha)$ for E<100 keV, and $^{235}U(n,f)$ for E>10 keV. Backgrounds were measured by recording signals from blank backing foils. Author (NSA)

N66-31074# Oak Ridge National Lab., Tenn.
DIFFERENTIAL ELASTIC SCATTERING OF NEUTRONS FROM NITROGEN
J. L. Fowler, C. H. Johnson, and R. L. Kernell 1965 14 p refs Presented at Am. Phys. Soc. Conf. of Neutron Cross Section Technol., Washington, D. C., 22–24 Mar. 1966
(Contract W-7405-ENG-26)
(CONF-660303-4; ORNL-P-2026) CFSTI: HC $1.00/MF $0.50

Differential cross sections were measured at energies between 1.595 and 3.207 Mev. A detailed discussion of the results is presented. NSA

N66-31087# Los Alamos Scientific Lab., N. Mex.
MEASUREMENTS ON THE CAPTURE CROSS-SECTION OF U-238 WITH BOMB SOURCE NEUTRONS
N. W. Glass, J. K. Theobald, A. D. Schelberg, J. H. Warren, and L. D. Tatro [1965] 11 p refs Presented at the Am. Phys. Soc., Conf. of Neutron Cross Sect. Technol., Washington, D.C.
(Contract W-7405-ENG-36)
(LA-DC-7613; CONF-66303-20) CFSTI: HC $1.00/MF $0.50

Measurements of the neutron capture cross-section of ^{238}U by neutron time-of-flight utilizing the pulse source of neutrons from a nuclear device were made on the Parrot and Petrel underground shots at the Nevada Test Site. The neutron flight path was approximately 200 meters. Three ^{238}U samples of 200, 200, and 16.6 barns/atom, respectively, were in the beam and viewed by a variety of Moxon-Rae type photomultiplier and solid-state detectors, resulting in a self-indication type of measurement from which resonance parameters can be derived for resonances from 36.7 to ~2000 ev. Experimental details, data recording techniques, and results are described. Author (NSA)

N66-31091# Los Alamos Scientific Lab., N. Mex.
RELATIVE FISSION CROSS SECTIONS OF 238U, 237NP, AND 235U
W. E. Stein, R. K. Smith, and J. A. Grundl [1966] 18 p refs Presented at the Am. Phys. Soc., Conf. of Neutron Cross Sect. Technol., Washington, D. C.
(Contract W-7405-ENG-36)
(LA-DC-7617; CONF-660303-24) CFSTI: HC $1.00/MF $0.50

Fission cross-section ratios $^{238}U/^{235}U$ and $^{237}Np/^{235}U$ were measured with pulsed, monoenergetic neutrons in the energy range 1.0 to 5.0 Mev with time-of-flight background discrimination. Vacuum evaporated fissile deposits (~0.5 mg/cm^2) were placed back to back between two 9.5 cm^2 surface barrier detectors. Slow and fast output signals were obtained simultaneously from each detector by means of separate electronic systems. Slow, linear pulses which exceeded a lower bound set to reject alpha particles were identified as fission events. The fraction of fragment pulses below this bias, determined from an extrapolation of the pulse-height spectrum, was ~1.2%. Only those fissions events which occurred during a few nanoseconds after the neutron burst were recorded. This time interval, determined by the measured time resolution (1.3 nsec FWHM) and the time walk of the smallest pulses (~2 nsec), was typically 10 nsec. Fission events induced by scattered neutrons which occur at later times were excluded. Characteristics of this detector and electronic system are presented along with the measured cross section ratios. Author (NSA)

N66-31094# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
EXPERIMENTS ON THE REACTION OF HIGH TEMPERATURE STEAM WITH PYROLYTIC-CARBON-COATED (Th,Au) C_2 PARTICLES
R. D. Burnette, J. M. Dixon, D. R. Lofing, and L. R. Zumwalt 28 Mar. 1966 34 p refs Presented at the Libby/Cockcroft Meeting on Graphite Chem., Harwell, England, 25–26 Apr. 1966
(Contract AT(04-3)-167)
(GA-7005; CONF-660409-1) CFSTI: HC $2.00/MF $0.50

Experiments on the compatibility of pyrolytic-carbon-coated U, Th fuel particles with high-temperature steam are discussed. Oxidation rates and particle failure times for both irradiation (i.e., catalyzed) and unirradiated (i.e., noncatalyzed) pyrolytic-carbon-coated (Th, U)C_2 particles at temperatures from 1000 to 1400° C and using steam partial pressures of 0.025 and 0.22 atm in flowing He are presented. A comparison of particle failures is given where particles are steam oxidized, unsupported, and protected by sacrificial graphite. Author (NSA)

N66-31153# Pittsburgh Univ., Pa. Space Research Coordination Center.
FORMAL SCATTERING THEORY AND THE COULOMB PROBLEM
Levere Hostler 27 Dec. 1965 55 p refs
(Contract Nonr 624(16))
(SRCC-24; AD-621385) CFSTI: HC $3.00/MF $0.50

It is attempted to salvage the usual apparatus of formal scattering theory in the case when there is a Coulomb field present. For this purpose, the time dependent approach to formal scattering theory is here presented without the use of adiabatic switching. Asympototic limits are investigated with the help of the Riemann–Lebesgue lemma. For scattering by a regular potential, the usual golden rule and the Lipmann–Schwinger equation are obtained. The same formalism is applied to the case of the Coulomb potential, and is found to bypass the ambiguities and 'wrong' factors which were encountered by a number of authors, and which are due to the anomalous behaviour of the Coulomb T-matrix on the energy shell. Other mathematical pathologies still remain in the Coulomb case, but these now take the form of infinite phase factors, and are presumably fairly innocuous. Author (TAB)

N66-31188# European Space Vehicle Launcher Development Organization, Paris (France). Basic Techniques Div.
RELATIVISTIC EQUATIONS AND SPACE RESEARCH. PART I: SPECIAL RELATIVITY [LES ENONCES RELATIVISTES ET LA RECHERCHE SPATIALE. PREMIERE PARTIE: LA RELATIVITE RESTREINTE]
E. Cambi Apr. 1966 50p refs In FRENCH; ENGLISH summary
(ELDO-TM-F-29) CFSTI: HC $2.00/MF $0.50

After having reviewed the fundamental notions of relativistic kinematics and especially the Lorentz transformation, the results concerning optical phenomena (invariance of the velocity of light, Doppler effect, propagation of light in moving refringent medium) and the chief notions of relativistic dynamics (rest mass, mass-velocity relation, mass-energy relation) are discussed. The nuclear aspects of this last relation are stressed. Author

N66-31283# Illinois Univ., Urbana. Dept. of Physics.
INVESTIGATION OF ISOBARIC ANALOGUE STATES BY (p,n) REACTIONS FOLLOWED BY PROTON EMISSION
A. I. Yavin, R. A. Hoffswell, L. H. Jones, and T. M. Noweir [1966] 7 p refs Sponsored in part by NONR
(AD-633098) CFSTI: HC $1.00/MF $0.50

A method is described for investigating proton unstable isobaric analogue states, in which $(Z+1)^{A^*}$ denotes the analogue of the ground state of the nucleus Z^A. It is pointed out that when the state $(Z+1)^{A^*}$ is proton unstable, the state can be studied by observing the protons from its decay. In the experiment discussed, the reaction Zr^{91} $(p,n\bar{p})$ Zr^{90} was selected since Nb^{91*} is proton unstable, but neutron stable. The relevant level diagram for this reaction is shown. Proton spectra were recorded at a laboratory scattering angle of 135°. Particle identification was accomplished by using 90μ and 2100μ detectors in a Δ E-E mass discrimination setup. Figures depict the proton spectra resulting from the bombardment of Zr^{91} with 12.35 MeV protons, and with 12.95 MeV protons; and the sum of proton spectra corresponding to incident proton energies ranging from 12.35 MeV to 12.95 MeV steps of approximately 120 keV. The procedures are discussed, and it is pointed out that their use broadened all prominent peaks with the exception of the p peak. It was concluded that the $(p,n\bar{p})$ reaction, when feasible, has the advantage of the large cross section of the (p,n) reaction, while bypassing the difficulties of neutron spectroscopy. M.G.J.

N66-31284# Michigan Univ., Ann Arbor. Dept. of Physics.
THE $\pi^+\pi^-$ INTERACTION AS STUDIED IN 12 AND 18 GeV PION-NUCLEON REACTIONS Technical Report 22
L. W. Jones, D. O. Caldwell, B. Zacharov, D. Harting, E. Bleuler et al Apr. 1966 25 p refs
(Contract Nonr-1224(23))
(Rept.-03106-22-T; AD-632940) CFSTI: HC $1.00/MF $0.50

From a study of peripheral interactions wherein a negative pion of 12 or 18 GeV/C incident on a nucleon produced a pair of high-momentum pions, the pion–pion S-wave interaction was deduced. A pion–pion cross section falling smoothly from 50 Mb (300 MeV) to 20 Mb (600 MeV) was observed. The forward–backward asymmetry was negative for low dipion masses. Author (TAB)

N66-31333# Stanford Univ., Calif.
A TEST OF QUANTUM ELECTRODYNAMICS BY ELECTRON-ELECTRON SCATTERING
W. C. Barber, B. Gittelman, G. K. O'Neill (Princeton Univ.), and B. Richter Apr. 1966 10 p refs Submitted for Publication
(Contracts Nonr-225(67); Nonr-1858(39); AT(04-3)-515)
(HEPL-438; SLAC-194; AD-633298) CFSTI: HC $1.00/MF $0.50

A test of quantum electrodynamics was made by studying the angular distribution of electrons scattered in the reaction $e^-+e^- \rightarrow e^-+e^-$. A center of mass energy of 600 MeV was made possible by storage rings each containing circulating electron beams of 300 MeV. Author (TAB)

N66-31374*# Purdue Univ., Lafayette, Ind. Dept. of Chemistry.
RECOIL RANGES OF PRODUCTS FROM REACTIONS OF Cu^{65} WITH 11-33 MeV He^3 IONS
G. B. Saha and N. T. Porile [1965] 14 p refs
(Grant NGR-15-005-021)
(NASA-CR-76396) CFSTI: HC $1.00/MF $0.50 CSCL 20H

Average projected ranges have been determined for the (He^3,n), $(He^3,2n)$, and (He^3,α) reaction of Cu^{65} over the energy range of 11-33 MeV. The results have been compared with calculations based on the assumption of compound nucleus formation. Excellent agreement is obtained for the $(He^3,2n)$ reaction at all energies and for the (He^3,n) reaction up to 17 MeV. The ranges of Cu^{64} are much smaller than the theoretical values at all energies indicating that the (He^3,α) reaction involves a direct interaction. Author

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N66-30018# Dartmouth Coll., Hanover, N. H. Dept. of Physics.
A TWO-TEMPERATURE THEORY FOR A HELIUM ARC PLASMA IN A CYLINDRICAL DUCT
Agnar Pytte and Niels K. Winsor Wright-Patterson AFB, Ohio, ARL, 1965 15 p refs
(Contract AF 33(657)-8179)
(ARL-66-0047; AD-632422) CFSTI: HC $1.00/MF $0.50

A simple theoretical model with different electron and heavy particle temperatures is applied to a high pressure helium arc in a cooled cylindrical duct. Single temperature theories predict a universal curve independent of duct radius for dissipated power versus the product of the axial electric field and the duct radius. The experimentally measured deviations from this universal curve are explained by the two temperature theory. The current-voltage characteristic of a cylindrical wall segment probe is also understood in terms of an elevated electron temperature, often exceeding the heavy particle temperature by an order of magnitude near the wall. Author (TAB)

N66-30036# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
HEAT TRANSFER EFFECTS ARISING FROM ARC ROTATION IN PLASMA ARC HEATERS OF THE SELF-INDUCED MAGNETIC FIELD TYPE
E. A. Bunt Dec. 1965 54 p refs
(Contract NOw-62-0604-c)
(T6-759; AD-632207) CFSTI: HC $5.60/MF $0.50

The paper is concerned with an analysis of the thermal behavior of high input power (about 15 megawatt) arc heaters operating at values of total (bulk) enthalpy up to 2500 btu/lb. The electrode system is essentially a 'rail accelerator' adapted for continuous operation by making it re-entrant; the self-induced magnetic field brings about rapid movement of the arc roots to prevent destruction of the electrodes. The rate of rotation of the arc column (which is subject to aerodynamic drag) is shown to be a function of apparent electrode gap and current and the stagnation temperature and pressure in the arc chamber. A distinction can also be drawn between long and short arcs, depending on whether the interelectrode gap is large or small. The value of the arc rotation rate (which ranges between about 50 and 1000/sec) had a considerable bearing on the thermal efficiency of short-gap arcs because of the dependence of the convective losses on it. Author (TAB)

N66-30076*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

OPTIMIZATION OF ADIABATIC MAGNETIC MIRROR FIELDS FOR CONTROLLED FUSION RESEARCH

J. Reece Roth Washington, NASA, Jul. 1966 43 p refs (NASA-TM-X-1251) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Guidelines are formulated for the design of magnetic mirror machines used in controlled fusion research apparatus; and an optimization problem is considered in which the dimensions, field strength, and mirror ratios of the mirrors are adjusted so as to adiabatically confine the largest possible number of particles per unit cost in the magnetic field coils. Scaling relations, derived for both conventional and superconducting coils, relate the cost of coils to coil dimensions and magnetic field strength produced. It is shown that for many conditions, such as conventional water-cooled copper coils, no optimum design exists; and that the total number of adiabatically confined particles is proportional to the amount of capital invested in the magnetic field coils. For superconducting coils, however, optimum values exist for magnetic field strength, coil dimensions, and mirror ratios; and the latter is relatively insensitive to the scaling law parameters for magnet cost. M.W.R.

N66-30090# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM ON THE OPTIMUM DISTRIBUTION OF CONDUCTIVITY OF A FLUID MOVING IN AN EXTERNAL MAGNETIC FIELD

K. A. Lur'ye *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 52–70 refs (See N66-30086 17-23)

The electric conductivity, and the current distribution of a fluid moving in an external magnetic field are discussed. Equations are derived for the magnetohydrodynamic flow in a flat channel with finite electrodes, and for certain boundary value problems of magnetohydronamics. From the literature reviewed, details are reported on the problem being considered: the construction of optimum distributions of conductivity in the case of a magnetic field varying with the x coordinate. It is stated that changes in the magnetic field with coordinate x appear as discontinuities of the conductivity. The magnitude of given functional I, associated with the optimization of distribution of conductivity, is compared with the magnitude of constant conductivity. Formulas are also presented for the components of current density. R.Ll.

N66-30091# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN TWO-DIMENSIONAL PROBLEMS ON THE DISTRIBUTION OF ELECTRICAL CURRENT IN A CHANNEL OF MAGNETOHYDRODYNAMIC GENERATOR WITH NONCONDUCTING PARTITIONS

A. B. Vatazhin and N. G. Nemkova *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 71–91 refs (See N66-30086 17-23)

In this work it is pointed out that the problem of determining the characteristics of a generator with nonconducting partitions in the case of a uniform magnetic field and in the case of a field concentrated only in the electrode zone, reduces to a problem consisting in determining the current flowing through the channel owing to the difference between potentials applied to the electrodes with the velocity of the medium and magnetic field strength equal to zero. Conditions under which an analytic solution of the problem for a channel with partitions can be constructed by means of simple solutions for channels without partitions. Results of modeling the problem in an electrolytic bath are given. Author

N66-30092# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEAT EXCHANGE IN A COMPLETELY IONIZED NONISOTHERMAL PLASMA, MOVING IN A CHANNEL WITH MAGNETIC FIELD

V. V. Gogosov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 92–109 refs (See N66-30086 17-23)

The problem on the motion of a completely ionized nonisothermal plasma in a flat channel is examined. Formulas are written out for the distribution of speed, density of currents, and temperatures of components across the channel section. The written expressions include a number of parameters: the impedance of external load, the Hartman number, parameters characterizing anisotropy of transfer coefficients, etc. There is ascertained the influence of these parameters on distribution of temperatures of components across the channel section. Author

N66-30093# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

FLUXES OF PARTICLES AND HEAT IN A PLASMA ALONG A STRONG MAGNETIC FIELD

Yu. M. Aliyev and A. R. Shister *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 110–119 refs (See N66-30086 17-23)

Transport phenomena in a completely ionized electron-ion plasma are examined in the case, when the mean Larmor radii may be found to be smaller than the Debye shielding distance of the Coulomb interaction. Proceeding from a kinetic equation, which takes into account the influence of magnetic field on the action of the collision of particles, fluxes of particles and heat are obtained along the field. Author

N66-30104# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STABILITY OF A FLUID LAYER WITH A VARIABLE DENSITY IN THE PRESENCE OF A MAGNETIC FIELD

V. A. Vardanyan *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 263–266 refs (See N66-30086 17-23)

The relationship between the stability of flat layer of an incompressible nonuniform fluid and orientation of magnetic field is investigated. It is pointed out that the region of unstable harmonics narrows with an increase of angle between the magnetic field and the axis of symmetry of the layer. Author

N66-30105# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF SHAPE ORIENTATION, AND CONDUCTIVITY OF BODIES ON THEIR ELECTROMAGNETIC EJECTION FROM A CONDUCTING FLUID

A. V. Andreyev and U. Ts. Andres *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 267–275 refs (See N66-30086 17-23)

In connection with the problem of separation of mineral grains according to specific weights in a conducting fluid with a current in magnetic field, the influence of the shape, orientation, and conductivity of the separated grains on the magnitude of electromagnetic ejecting forces experienced by them is investigated. Author

N66-30106# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HEAT TRANSFER IN THE FLOW OF AN ELECTROCONDUCTING FLUID AT LOW VALUES OF THE MAGNETIC REYNOLDS NUMBER

I. I. Novikov and L. D. Pichakhchi *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 276–280 refs (See N66-30086 17-23)

Heat transfer processes in an electroconducting fluid moving in a magnetic field were studied. It is stated that these processes are more complex than the heat transfer in ordinary fluid flow because induction currents develop which result in the liberation of Joule heat. A formula is provided which establishes a relationship for the heat transfer, and to evaluate its accuracy it is compared with solutions of the equations of motion of a conducting fluid in a magnetic field. From these comparisons, it is stated that the formula provided correctly describes the transmission of heat through a laminar boundary layer during the flow of a conducting fluid in a transverse magnetic field, and is recommended for practical calculations. H.S.W.

N66-30110# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHOTOGRAPHIC INVESTIGATION OF PULSATIONS IN PLASMATRONS WITH AN AIR STABILIZATION

A. M. Trokhan *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 315–324 refs (See N66-30086 17-23)

The use of optical windows in the form of various kinds of slots has made it possible to conduct a number of investigations in the dynamics of burning in rocket motors. In using the slots located along the flow and across it, pulsations are studied in plasmatrons with an air stabilization by means of high-speed photoregistrations on moving film. Author

N66-30147# Naval Research Lab., Washington, D. C.

THE NRL SOZOTRON PROJECT

D. C. de Packh *In its* Rept. of NRL Progr. Mar. 1966 p 9–20 refs (See N66-30146 17-23) CFSTI: $1.25

The Mark I sozotron electron storage ring, with a design level of 100 keV at 10 amperes, is described. The operating and design parameters are outlined, and a schematic is included. It is pointed out that the purpose of the Mark I sozotron is to permit experimental investigations of the unstable modes and to test methods of curing the unstable behavior for the eventual construction of the Mark III device, which will have a contained beam intensity of the order of 1 kiloampere at 100 MeV. The steering instability of the Mark I device appeared to be the most serious instability, and is controlled by an inverse feedback process which also suppresses betatron oscillations caused by errors in the guide field. Longitudinal resistive-wall and negative-mass instabilities are mentioned. Nonlinearity, of predominant significance because of the large number of betatron wavelengths per turn associated with strong focusing, is discussed. Typical pictures of short term and long term containments are presented. N.E.N.

N66-30152# General Motors Corp., Indianapolis, Ind. Allison Div.

NONEQUILIBRIUM IONIZATION FOR MPD POWER GENERATION

Donald L. Tipton and T. L. Rosebrock *In its* Allison Res. and Eng., Vol. 10 [1966] p 2–19 refs (See N66-30151 17-34)

Analytical studies of nonequilibrium ionization methods for closed loop, low temperature (1500° to 2000°K) magnetoplasmadynamic (MPD) power generation are summarized. Results indicate that magnetically induced ionization is the most optimum method. The results further indicate that some method of preionization by an auxiliary process may be required to overcome the problem of inlet relaxation. D.T.

N66-30183*# General Dynamics Corp., San Diego, Calif.

ELECTRODE PHENOMENA IN HIGH ENERGY DENSITY DISCHARGES AS APPLIED TO PLASMA ACCELERATION PROBLEMS

Helmut Poppa Washington, NASA, Jul. 1966 61 p refs (Contract NASw-1103)

(NASA-CR-506) CFSTI: HC $3.00/MF $0.75 CSCL 20I

Plasma-electrode interactions were investigated, especially microscopic and submicroscopic changes in electrode surface structure and morphology. Transmission electron microscopy of crystallographically well-defined thin foil electrodes showed that the orientation dependence of the sputtering yield is weak for low ion energies. Transmission electron diffraction of Cu foils bombarded with 500 eV nitrogen ions revealed no sign of chemical corrosion attack. Reflexion electron diffraction of a bulk copper cathode exposed to a nitrogen discharge in a coaxial plasma gun confirmed the negative corrosion results. Cathode morphologies of two plasma gun types were studied by replica electron microscopy as they developed during gun operation. Microscopic structure features found on electrode surfaces indicate the existence of small areas of localized surface attack. The attack is so strong that localized melting of the cathode surface occurs. The melting hypothesis was verified by detecting changes in cathode surface crystallography caused by localized melting of cathode material. Author

N66-30184*# Mithras, Inc., Cambridge, Mass.

ELECTRON ATTACHMENT TO ATOMIC FLUORINE IN THERMALLY IONIZED AIR

R. Earl Good Washington, NASA, Jul. 1966 50 p refs (Contracts NASw-601; NASw-941)

(NASA-CR-516) CFSTI: HC $2.00/MF $0.50 CSCL 20I

Fluorine gas is considered as a means of reducing the electron concentration during atmospheric reentry. It is anticipated that the addition of fluorine gases to a reentry plasma can alleviate radio communications blackout. The fluorine gases were investigated using a shock tube and wedge nozzle at throat conditions of 1 1/2 atmospheres and 3840°K. The fluorine gases, SF_6 and CF_4, were premixed with air in the shock tube. The gases completely dissociated into atomic species prior to expanding into the nozzle and attaching electrons. Microwave interferometer measurements were made to determine the electron densities with and without fluorine gas additives. An Arrhenius type rate law was fit to the measurements of electron density to derive a rate coefficient for the fluorine attachment reaction. Author

N66-30292*# National Aeronautics and Space Administration, Washington, D. C.

PROBLEMS OF PLASMA THEORY

Apr. 1965 223 p refs Transl. into ENGLISH of Vopr. Teorii Plazmy (Moscow), no. 4, 1964 p 1–187

(NASA-TT-F-9274) CFSTI: HC $6.00/MF $1.25 CSCL 20I

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N66-30293*# National Aeronautics and Space Administration, Washington, D. C.
HYDRODYNAMIC DESCRIPTION OF A STRONGLY-RAREFIED PLASMA
T. F. Volkov *In its* Probl. of Plasma Theory Apr. 1965 p 3-21 refs (See N66-30292 17-25) CFSTI: HC $6.00/MF $1.25

Several examples are given to show that a hydrodynamic description of a plasma without collisions can be used at least as a heuristic method for obtaining results which are qualitatively correct. Two equations for electrons and ions are examined, together with the Maxwell equations; in deriving the hydrodynamic equation from the kinetic equation, the moments of the distribution function are considered. An approximation is formulated to show that electron velocities differ little from ion velocities, primarily due to the presence of a self-consistent magnetic field. Hydrodynamic equations which describe the behavior of a rarefied plasma in a strong magnetic field are examined; and the mean macroscopic velocity of a given type of particle is calculated. The motion equation for a quasi-neutral plasma is also derived, along with equations for solving the problem of small fluctuations of a nonisothermic plasma. Relationships which are analogous to those for an isotropic plasma are obtained. L.E.W.

N66-30294*# National Aeronautics and Space Administration, Washington, D. C.
COLLECTIVE PROCESSES AND SHOCK WAVES IN A RAREFIED PLASMA
R. Z. Sagdeyev *In its* Probl. of Plasma Theory Apr. 1965 p 22-87 refs (See N66-30292 17-25) CFSTI: HC $6.00/MF $1.25

The theory of collective processes in a rarefied plasma is discussed, with primary attention given to clarifying the physical meaning by an examination of different approximate models. This theory was then used to construct a theory for the thickness of shock waves in a rarefied plasma. The collective process is discussed including the interaction between particles in a plasma, plasma fluctuations and waves, the distribution function of the particles with respect to velocity, instability in relation to wave-like distortions of magnetic field force lines, and plasma state changes caused by instability. A systematic presentation of the theory of nonlinear, non-damped fluctuations is given, emphasizing a qualitative examination of nonlinear deformation of the form of any initial disturbance, asymptotic motions and damping without collisions in a rarefied plasma, and determination of stability with respect to different random distortions. A theory of shock waves without collisions was then constructed as follows: a laminar theory was formulated based on the concept of regular fluctuations, the stability of these solutions was studied, and in unstable cases, or where laminar solutions did not exist, a turbulent theory was constructed. L.E.W.

N66-30295*# National Aeronautics and Space Administration, Washington, D. C.
COULOMB COLLISIONS IN A FULLY IONIZED PLASMA
D. V. Sivukhin *In its* Probl. of Plasma Theory Mar. 1965 p 88-206 refs (See N66-30292 17-25) CFSTI: HC $1.00/MF $1.25

Problems involving the collision of two particles are examined, with attention focused on approximate solutions to pair collisions. The concepts and results which are necessary conditions for deriving a kinetic equation in the pair collision approach are considered in relation to stable or quasi-stable states for which the distribution functions are borrowed from statistics. Derivations of the kinetic equation are given for a fully ionized or hot plasma, consisting of electrons and bare atomic nuclei. Several examples are presented to show its applications. The physical assumptions underlying the theory of pair collisions is discussed, along with the nature of the indicated divergence. Finally, it is shown that the assumption of finite interaction time in a scheme of pair interactions leads to the results produced by the idealized collision scheme when the interactions are assumed to be instantaneous. L.E.W.

N66-30330*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
THE CONTRIBUTION OF ELECTRON-ELECTRON COLLISIONS TO THE EMISSION OF BREMSSTRAHLUNG BY A PLASMA
Thomas J. Birmingham, John M. Dawson, and Russell M. Kulsrud (Princeton Univ.) Mar. 1966 46 p refs Submitted for Publication Prepared Jointly with Princeton Univ.
(Contract AT(30-1)-1238; Grant NSF GP-579)
(NASA-TM-X-55507; X-641-66-89) CFSTI: HC $2.00/MF $0.50 CSCL 20I

A model for treating plasma radiation processes in plasmas is extended to the problem of bremsstrahlung emission from electron-electron collisions. The spectra of longitudinal and transverse waves, including dielectric effects, are derived to lowest non-vanishing (quadrupole) order. A resonance in the spectrum of transverse waves near $\omega = 2\omega_p$, the first harmonic of the electron plasma frequency, is noted. The high frequency form of the transverse spectrum is approximately evaluated and found to be relativisitically small by comparsion with the dominant electron-ion bremsstrahlung. Finite wave length corrections to the radiation generated by electron-ion collisions are also discussed. Author

N66-30427# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
THE INTERNAL POTENTIAL FALL IN MHD GENERATORS [DER INNERE POTENTIALABFALL IN MHD-GENERATOREN]
M. Salvat Apr. 1966 18 p In GERMAN; ENGLISH summary (IPP-3/38) CFSTI: HC $1.00/MF $0.50

The influence of electrode dimensions on potential electrical field drop and thus internal resistance increase in a MHD generator was evaluated by utilizing the physical parameters of the electrode pairs to obtain the corresponding current distributions. The following formula was obtained:

$$\frac{\Delta\phi i^*}{\Delta\phi^*} = \frac{Ri}{R} = \frac{1}{A+\beta D}$$

where $\Delta\phi^*$ and R constitute the potential drop and the internal resistance, "i" denotes the ideal case, $\beta = \omega\tau$ represents the Hall coefficient, and A and D are the explicit functions of electrode geometry and relative positions.
Transl. by G.G

N66-30469# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
MEASUREMENT OF THE ENERGY OF PLASMA PARTICLES WITH A BIASED PYROMETRIC PROBE [MESURE DE L'ENERGIE DES PARTICULES D'UN PLASMA A L'AIDE DE LA SONDE PYROMETRIQUE POLARISEE]
Richard Geller Oct. 1965 16 p refs In FRENCH
(CEA-R-2853)

The use of a biased pyrometric probe, a Langmuir probe made of carbon or tungsten, in the measurement of the energy of plasma particles is discussed. For hot and dense plasmas, the radiation power of the probe is compared with the product of the current and voltage of the characteristic curve.
TAB

N66-30595*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
ANALYSIS OF BOUNDARY LAYER STRUCTURE IN A SHOCK-GENERATED PLASMA FLOW. PART 1: EQUILIBRIUM IONIZATION
Stellan Knoos May 1966 170 p refs *Its* Rept.-80
(Grant NGR-05-020-091)
(NASA-CR-76247; SUDAAR-277) CFSTI: HC $5.00/MF $1.00 CSCL 20I

The structure of some convective, laminar boundary layers in a high density shock-heated 1 eV argon plasma is investigated theoretically. A general three-fluid continuum formulation of the problem is presented, and the equations solved for the case of thermo-chemical equilibrium with no applied electromagnetic fields. Solutions for boundary layer profiles and other quantities are presented for plasma boundary layers forming over a cold, infinite flat plate with an impulsively started motion in its own plane (Rayleigh's boundary layer), and the boundary layer behind a plane, ionizing shock wave moving over an infinite plane wall (shock tube side-wall boundary layer). Accurate transport data for partially ionized argon are calculated and used in the analysis. The induced electric field is shown to be of fundamental importance to these properties. Associated with the ambipolar diffusion is an electric potential difference of the order 10 Volts, which is much larger than the potential difference across the sheath. The assumptions of chemical and temperature equilibrium are checked in a rigorous way. It is found that equilibrium ionization will not exist close to the wall below typically 10,000°K, and that the electron temperature, which was calculated in a linearized model, is larger than the ion-atom temperature in the same region.
Author

N66-30609*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
RADIATIVE BEHAVIOR OF SHOCK HEATED ARGON PLASMA FLOWS
Kenneth P. Horn May 1966 120 p refs *Its* Inst. of Plasma Res. Rept.-79
(Grant NGR-05-020-091)
(NASA-CR-76237; SUDAAR-268) CFSTI: HC $4.00/MF $0.75 CSCL 20I

Experimental and theoretical studies were made of the decrease in the degree of ionization of shock heated argon resulting from radiative emission. Optical interferometry, in conjunction with a rotating mirror camera, provided a time history of the mass and electron densities following strong shocks. After a short electronic relaxation period the hot, highly luminous gas reached local thermodynamic equilibrium. Then, loss of energy by radiation led to cooling of the gas as evidenced by the decreasing electron density. On the assumption that the dense plasma (10^{17} electrons per cc) passed through successive equilibrium states upon cooling, the change in temperature and in number density of the electrons could be related by use of the Saha equation. The change in degree of ionization thus determined compared favorably with calculated values, assuming continuum emission by free-free and free-bound transitions and emission from spectral lines.
Author

N66-30630# Michigan Univ., Ann Arbor. Dept. of Nuclear Engineering.
AN ELEMENTARY REVIEW OF THE SCATTERING OF PHOTONS BY HIGHLY IONIZED PLASMAS
R. K. Osborn Feb. 1966 35 p refs *Its* Rept.-07599-3-T
(Contract DA-31-124-ARO(D)-403; Proj. Defender)
(AROD-6092-4; AD-622074) CFSTI: HC $2.00/MF $0.50

A theory is developed for the scattering of photons by equilibrium plasmas sufficiently highly ionized that the presence of neutrals can be traced from start to finish with minimal recourse to outside literature. Furthermore, the theory is developed systematically so that schemes for generating higher order approximations are clearly delineated at each stage in the argument. The problem is divided into two almost independent parts. In the first exclusive concern is given to the establishment of a relationship between the observed distribution of scattered photons, and the dynamical and statistical characteristics of the scattering plasma. In the second area, attention is given entirely to the calculation of the electron density autocorrelation function.
C.T.C.

N66-30631# Texas Univ., Austin. Dept. of Physics.
HELICAL ANOMALIES IN RF PLASMAS Final Report, Apr. 1, 1963–Mar. 31, 1966
Hans Schluter [1966] 4 p refs
(Grant DA-ARO(D)-31-124-G438)
(AROD-4159-4; AD-633327) CFSTI: HC $1.00/MF $0.50

An examination was made of the range of occurrence and the features of the helical anomalies in radio frequency plasmas. The helical structures have usually been observed as mode four or five, but also the mode six and lower modes including mode two have been found. The structures occur for a variety of conditions. Magnetic field configuration, the oscillator frequency, and the coupling conditions influence the behavior of structures, but they are not essential parameters for their occurrence. However the structures are not always observed, they are not observed for medium gas pressures and very high power levels. The structures generally rotate around the axis of the magnetic field with a sensitive dependence of the rotation frequency on the magnetic field strengths. It is reported that these helical modes are not associated with a castrophic development of diffusion and that they deviate in essential features from the ordinary helical instabilities. The onset of enhanced losses occur already at a magnetic field strength lower than those for the occurrence of (rotating or stationary) helical modes.
C.T.C.

N66-30733# Michigan Univ., Ann Arbor.
THE MAGNETIC STABILIZATION OF AN ELECTRIC ARC IN TRANSVERSE SUPERSONIC FLOW
Charles E. Bond Wright-Patterson AFB, Ohio, ARL, Oct. 1965 146 p refs
(Contract AF 33(657)-8819)
(ARL-65-185; AD-632677) CFSTI: HC $4.00/MF $1.00

A method is presented for the magnetic confinement and stabilization of a d–c electric arc in an unheated supersonic airstream directed normal to the electric field. It is shown that stable confinement is governed by dynamic processes in the positive column, and is independent of material and flow conditions at the surface of the cathode. The positive column exhibited remarkable spatial stability when allowed to slant across the electric field, parallel to a freestream Mach line. Under conditions where the column could not follow the Mach angle, a very unstable discharge was observed. The direction of column slanting was the Hall direction, cathode-root downstream; but the magnitude of the slant angle was not affected by changes in the Hall parameter, corresponding to changes

in ambient pressure, arc current, and local magnetic induction by factors of 2. At the Mach numbers investigated, 2.0 and 2.5, the stable column invariably followed the Mach angle—which happens to be very nearly the angle corresponding to a maximum in the discharge parameter, the ratio of parallel component of electric field to pressure at the upstream boundary of the arc. The experimental results demonstrate the possibility of stable conduction of electricity through transverse supersonic flow, and suggest that such conduction is governed by a convective interaction mechanism which is not entirely Hall-effect. TAB

N66-30871*# Massachusetts Inst. of Tech., Cambridge.
INFLUENCE OF COMPRESSIBILITY ON CONDUCTION TYPE A.C. MHD GENERATORS
P. Ponthus (M.S. Thesis, 21 May 1965) Paris, ESRO, Apr. 1966 53 p refs Sponsored by NASA and ESRO
(NASA-CR-76376; ESRO-SN-4) CFSTI: HC $3.00/MF $0.50 CSCL 20I

General MHD equations for an a.c. compressible fluid model are stated in the quasi one-dimensional analysis. Equations for perturbations which occur in an a.c. compressible fluid model are developed with the aid of a quasi one-dimensional small amplitude analysis and a numerical calculation of the perturbation velocity is performed. The results are presented in the form of relative perturbations of velocity for various values of the appropriate parameters. The validity of the small amplitude analysis is evaluated. It has been found that the stability of a compressible flow increases when the Mach number at the inlet, the loading factor, and the frequency are increased. The active power density is reduced up to 20 percent in the range of conditions appropriated for power generations at 60 cps and a loading factor equal to 0.50. Then, with stability assured, the problem of understanding the a.c. energy conversion properties can be treated in the case of a steady-state incompressible fluid model. Author

N66-30944# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
ON THE POSSIBILITY OF USING A PURE INERT GAS AS WORKING FLUID IN M.H.D.-GENERATORS [UEBER DIE MOEGLICHKEIT, M.H.D.-GENERATOREN MIT REINEM EDELGAS ALS ARBEITSMITTEL ZU BETREIBEN]
W. Ohlendorf Dec. 1965 27 p In GERMAN; ENGLISH summary
(IPP-3/29)

A theory is developed for a nonequilibrium MHD-generator using a pure inert gas as working fluid. Relaxation-times for the electron-drift-velocity, the electron-temperature and the recombination were calculated. Author (NSA)

N66-30948# Miami Univ., Coral Gables, Fla. Center for Theoretical Studies.
PLASMA RADIATIONS Final Report, 1 Jun. 1964-31 Aug. 1965
Behram Kursunoglu Dec. 1965 135 p refs
(Contracts AT(40-1)-2761; AF 49(638)-1260)
(TID-22809; CST-PA-65-1) CFSTI: HC $4.00/MF $1.00

Separate detailed theoretical discussions are presented on the following: diffusion as a problem of statistical path, nonrelativistic theory of plasma oscillations, plasma diffusion across a magnetic field, relativistic plasma in the absence of a magnetic field, relativistic plasma in a magnetic field, and conservation laws of a relativistic plasma. NSA

N66-31006# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Energeticheskii Institut.
CALCULATION OF THE VOLT-AMPERE CHARACTERISTICS OF THE TEP (THERMOELECTRON POTENTIAL) IN AN ARC [K RASCHETU VOL'T-AMPERNYKH KHARAKTERISTIK TEPA V DUGOVOM REZHIME]
I. P. Stakhanov and I. I. Kasikov 1965 23 p refs In RUSSIAN
(FEI-17)

The transport equations in the diffusion approximation were formulated for gas discharge plasma. The ionization mechanism in the space was assumed to be thermal. The charge recombination was disregarded. The equations were solved for constant temperature of the ions (T_i) and electrons (T_e). Under this assumption it was shown that the ionization coefficient does not depend on the magnitude of the current. This result was obtained by means of exact solution of the equation on an electronic computer. Author (NSA)

N66-31181# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
ELECTROPHORETIC POWER GENERATION IN THERMALLY IONIZED PLASMAS
C. C. Leiby, Jr. and J. C. Fields Oct. 1965 38 p refs *Its* Phys. Sci. Res. Paper No. 151
(AFCRL-65-739; AD-623788) CFSTI: HC $2.00/MF $0.50

Druyvesteyn's solutions for electrophoretically induced gas flows in electrical discharges in gases were extended over a larger pressure range and corrected for the influence of Debye shielding effects. The effects of molecular or 'slip' flow were also taken into account. These more accurate and general solutions were applied to the reverse phenomenon of space charge field generation arising from the flow of a thermally ionized cesium plasma through a tube. Under such flow conditions, a nonlinear differential equation for the axial pressure distribution was obtained but not solved. However, it was possible to obtain estimates of the ranges of cesium pressure, temperature and tube radii which would be required for sensible levels of electric power generation. Anaphoretic flow power levels of the order of 0.1 to 10 watts, in tubes of laboratory dimensions (radii of 10 cm or less), appear feasible at temperatures from 1700 to 2400K. Sensible power generation levels at lower temperatures require very large diameter tubes, and therefore are not feasible. Author (TAB)

N66-31194# Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics Div.
ELECTRIC FIELD PARALLEL TO THE MAGNETIC FIELD IN A LOW-DENSITY PLASMA
Hans Persson 4 Apr. 1965 47 p refs
(Rept.-65-07) CFSTI: HC $2.00/MF $1.00

Stationary states of a collisionless plasma in one-dimensional magnetic mirror field are considered. The parallel electric field is assumed to be everywhere directed away from the point of minimum magnetic field. All particles are assumed to pass this point. Reflection and loss of particles are studied, the concept of isotropy is contemplated, and the density integrals are derived from Liouville's theorem. In a few cases the ion and electron densities and the electric field necessary to maintain quasi-neutrality are calculated. Possible applications to geophysics and to a laboratory experiment are discussed. Author

N66-31266# Polytechnic Inst. of Brooklyn, Farmingdale, N. Y.
RESEARCH ON ELECTROMAGNETICS FOR PROJECT DEFENDER Semiannual Technical Summary Report for Period Ending 31 Mar. 1966

Rudolf G. E. Hutter 31 Mar. 1966 301 p refs
(Contract Nonr-839(38); ARPA Order 529)
(PIBMRI-1295.2-66; AD-631859) CFSTI: HC $6.00/MF $1.50

Progress on a fairly large number of projects is described in the semiannual report. With one exception, these projects can be grouped into four categories: Plasma, electromagnetics, fluid dynamics, and ablation studies. The general theme of nearly all projects in the first three groups is the concern with the electromagnetic properties of ionized gases and/or plasmas, such as the properties of antennas, excitation of waves in plasmas, propagation through plasmas, measurement of electron densities of shock waves, measurement of electron densities of shock waves, precursor studies of shocks, instabilities in plasmas, properties of laboratory plasmas. One contribution is concerned with the basic kinetic theory of ionized media. A few others are concerned with gas flow problems. The work on ablation was just incorporated in the program, and one contribution deals with this subject. Author (TAB)

N66-31287# RCA Victor Co., Ltd., Montreal (Quebec). Research Labs.
ELECTROCHEMICAL PROPERTIES OF SEEDED PLASMA FLOW FIELDS II
A. I. Carswell, C. Richard, and A. K. Ghosh Jun. 1965 140 p refs
(Contract Nonr-4596(00); ARPA Order 665)
(RR-7-801-39; AD-632352) CFSTI: HC $4.00/MF $1.00

The effectiveness of various electronegative gases (O_2, CO_2, NO, SF_6, H_2O), as a means of reducing the ionization in plasma flow fields (nitrogen plasma) are experimentally investigated and compared. In the thermal condition prevailing, SF_6 and water vapor are found to be the most effective in quenching the plasma. Electrostatic probe, optical emission spectroscopy, thermocouple and no titration techniques are employed to monitor the plasma properties. The complex nature of the short duration pink afterglow in nitrogen is studied in some detail both in flowing and non-flowing systems in order to ascertain more quantitatively the effectiveness of the different quenching gases. The effects of gas pressure, wall condition and gas purity on the afterglow behaviour are closely examined in view of the reproducibility of measurements. A theoretical study of the limitations and applicability of electrostatic probe methods to plasmas containing negative ions is made and computations of characteristics are presented. Results of measurements of the flow velocity by different techniques are compared and the importance of an accurate determination of plasma flow field velocity is discussed. Author (TAB)

N66-31320# New Mexico State Univ., University Park. Research Center.
AN EXPERIMENTAL STUDY OF RADIO-FREQUENCY PLASMOIDS
August Miller and John R. Trimmier Apr. 1966 64 p refs
(Contract Nonr-3531(03))
(AD-632670) CFSTI: HC $3.00/MF $0.75

The primary objective was to obtain information about the average electrical potential distributions within rf plasmoid discharges by using a positive ion beam, and its deflections, as a probe which would introduce only small perturbations into the discharge. A secondary aim was the correlation of ion beam derived data with metallic probe data—one objective being the evaluation of the validity of data derived from metallic probes in the presence of highly non-Maxwellian electron (and, perhaps, ion) energy distributions. A third and, somewhat accidental, investigation covered the behavior of electrode-to-chamber voltages developed by the discharges. All of these investigations are discussed in some detail. TAB

N66-31344# RAND Corp., Santa Monica, Calif.
OUTFLOW OF A CONDUCTING GAS JET WITH ALIGNED MAGNETIC FIELD FROM A RECTANGULAR CHANNEL
S. A. Berger Apr. 1966 45 p refs
(Contract ARPA SD-79; ARPA Order 189-1)
(RM-4884-ARPA; AD-633027) CFSTI: HC $2.00/MF $0.50

The flow of an infinitely conducting gas with aligned velocity and magnetic fields out of a rectangular channel of finite width can be solved exactly by transformation to the hodograph plane. This solution was presented in an earlier Rand memorandum. The present work contains the calculation of the coefficient of contraction of the jet for various values of the basic parameters of the flow. (Author (TAB)

N66-31353*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FLOW OF ELECTRONS THROUGH A RAREFIED GAS BETWEEN PLANE PARALLEL ELECTRODES
Peter M. Sockol Washington, NASA, Jul. 1966 20 p refs
(NASA-TN-D-3510) CFSTI: HC $1.00/MF $0.50 CSCL 20I

The integral equation approach to the solution of the Boltzmann equation has been applied to the flow of electrons through a rarefied gas between plane parallel electrodes. A perfect Lorentz gas model is assumed. Self-consistent field solutions of the Boltzmann equation with Poisson's equation have been obtained for ratios of electrode spacing to mean free path of 0, 0.5, 1, and 2. Density and potential curves together with current-voltage characteristics are presented. Author

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Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N66-30000# Arizona Univ., Tucson. Dept. of Metallurgical Engineering.
A CINEPHOTOMICROGRAPHIC STUDY OF DYNAMIC DISLOCATION PHENOMENA IN CRYSTALS Final Report, Mar. 3, 1962–Jun. 30, 1965
Louis J. Demer Apr. 1966 12 p refs
(Grant DA-ARO(D)-31-124-G288)
(AROD-3400-5; AD-632554) CFSTI: HC $1.00/MF $0.50

A brief summary is presented of the investigations performed during specific studies were made of the indentation hardness of various crystals, certain dislocation phenomena in ionic crystals, and surface damage in semiconductor crystals. Experimental techniques employed in these studies included dislocation etch pitting, optical microscopy, and X-ray diffraction microscopy. Notes on the principal findings are presented. Author (TAB)

N66-30003# Controls for Radiation, Inc., Cambridge, Mass.
THE ADVANTAGES OF THERMAL CONDUCTIVITY IN MEASURING RADIATION PRODUCED COMPLEXES IN SILICON Scientific Report No. 2
Charles J. Glassbrenner Mar. 1966 30 p refs
(Contract AF 19(628)-5214)
(AFCRL-66-208; AD-632467) CFSTI: HC $2.00/MF $0.50

Phonon thermal conductivity theory is explained to show how thermal conductivity measurements can give the number and size of radiation produced complexes. A low temperature thermal conductivity apparatus is described which has a special sample holder for radiation experiments. Proposed experiments to study the radiation damage complexes in silicon containing oxygen and/or carbon are discussed. Author (TAB)

N66-30004# Controls for Radiation, Inc., Cambridge, Mass.
THE GENERATION OF AN IMPURITY-VACANCY PAIR IN SILICON DURING IRRADIATION Scientific Report No. 1
Sumner Mayburg 8 Apr. 1966 31 p refs
(Contract AF 19(628)-5214)
(AFCRL-66-181; AD-632466) CFSTI: HC $2.00/MF $0.50

Equations are solved for the buildup of an impurity-vacancy pair in silicon during irradiation assuming vacancy but not interstitial motion. For a given integrated flux, more pairs are shown to be produced at high than at low bombardment temperatures. When silicon interstitial as well as vacancy motion is considered. The steady-state concentration of vacancies trapped at impurities is found to be $r\ N_I(1+r)$ where r is the ratio of interstitial jump time to vacancy jump time and N_I is the concentration of impurities. The disappearance of the pairs after the irradiation ceases is determined by the jump time of the Si interstitials. Comparison of this simple first order theory with available experiments emphasizes the need for experiments to determine the state of the Si interstitial in irradiated silicon at room temperature. Either the Si interstitial is immobile at room temperature or it is trapped by substitutional impurity atoms as Watkins suggested from experiments on Al doped samples at 4K.
Author (TAB)

N66-30006# Delaware Univ., Newark. Dept. of Physics.
STATIONARY SOLUTIONS FOR INHOMOGENEOUS FIELD DISTRIBUTION IN HOMOGENEOUS SEMICONDUCTORS IN A RANGE OF NEGATIVE DIFFERENTIAL CONDUCTIVITY
K. W. Boer and P. L. Quinn Apr. 1966 17 p
(Contract Nonr-4336(00))
(TR-8; AD-631867) CFSTI: HC $1.00/MF $0.50

For a simple reaction-kinetic model of a homogeneous semiconductor layer-like field inhomogeneities have been shown to occur if and only if the decrease in conductivity is stronger than linear with increasing field. Such negative differential conductivity may be the result of either a field-dependent carrier concentration or a field-dependent mobility. The paper discusses only the stationary solutions of a system of differential equations representing the reaction-kinetic models of both these cases.
Author

N66-30009# Radio Corp. of America, Princeton, N. J.
HIGH FIELD TRANSPORT IN INSULATORS Final Report, 28 Feb. 1963–28 Feb. 1966
A. Rose 28 Feb. 1966 6 p refs
(Contract DA-31-124-ARO(D)-84)
(AROD-4017-11; AD-631959) CFSTI: HC $1.00/MF $0.50

The work reviews the state of the art on high field-transport in insulators, reopens the question of the mechanism for dielectric breakdown, and underlines the difficulties in the way of achieving solid state multiplication in insulators. In spite of these difficulties, the far ranging significance of solid-state multipliers demands, in my opinion, that the program be continued until either such multiplication is achieved or its impossibility is firmly demonstrated.
Author

N66-30145# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.
ORDERED MAGNETISM IN SOLIDS Annual Summary Report
D. Treves 1 Jan. 1965 9 p refs
(Contract AF 61(052)-654)
(AD-615590) CFSTI: HC $1.00/MF $0.50

The spontaneous ferromagnetic moment of 14 orthoferrites was measured at 80° to 900°K by torquemeter and vibrating sample magnetometer. Obtained values showed a rather weak rare earth/iron interaction. Measurements of the temperature dependence of the iron sublattice magnetization by Mossbauer spectrometer developed strong evidence that the weak ferromagnetism in the samples was due to antisymmetric exchange interactions. The lattice constants of the orthoferrites with Y, Tb, Dy, Ho, Eu, Tm, Yb, and Lu were calculated from X-ray powder data; preliminary calculations of their Curie points seem to fit the experimental values. Experimental results on the coercive force of orthoferrite single crystals by vibrating sample techniques showed good agreement with the Kondorsky 180° wall motion model. Theoretical analyses of the tensor properties that describe the quadratic dependence of the magnetization on externally applied fields developed that this tensor exists in all 31 ferromagnetic crystal classes in which it may have up to 10 independent parameters, whereas it exists in only 27 of the 59 antiferromagnetic crystal classes.
G.G.

N66-30160# Naval Ordnance Lab., Corona, Calif.
INFRARED ABSORPTION OF Ce^{3+} IN LaF_3 AND OF CeF_3
R. A. Buchanan, H. E. Rast, and H. H. Caspers *In its* Foundational Res. Proj. 1 Mar. 1966 p 11–20 refs (See N66-30157 17-23) CFSTI: HC $4.60/MF $0.50

The infrared absorption spectra of Ce^{3+} in LaF_3 and of CeF_3 have been observed in the region of 3 to 6 microns. For Ce^{3+} in LaF_3 the four absorption lines at 2160, 2240, 2635, and 2845 cm^{-1} that persist at liquid helium temperature are identified as transitions originating on the ground Stark component of the $^2F_{5/2}$ and terminating on the four Kramers-degenerate Stark levels of the $^2F_{7/2}$. Observation of the temperature dependence of the spectrum has revealed two additional transitions beginning on a $^2F_{5/2}$ Stark level 150 cm^{-1} above the ground state and ending on the two lowest levels of the $^2F_{7/2}$. The results are essentially the same for CeF_3 and are in substantial agreement with the results of temperature dependent studies of the magnetic susceptibility and Faraday rotation of CeF_3 and tysonite.
Author

N66-30186*# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.
RADIATION EFFECTS ON SILICON Fourth Quarterly Progress Report, Sep. 25–Dec. 31, 1965
E. G. Wikner and D. P. Snowden 10 Jan. 1966 14 p refs
(Contract NAS7-289)
(NASA-CR-78120; GACD-6249) CFSTI: HC $1.00/MF $0.50 CSCL 20L

Progress is reported on an investigation of radiation effects in silicon solar cells. During this period the experimental setup to study microwave conductivity was modified to obtain improved low temperature operation of the sample holder and better accuracy in conductivity measurements. Modifications were also made in the cavity to be used for the microwave resonance studies. Preliminary experiments were initiated to determine the indirect production of the divacancy in p-type silicon.
R.N.A.

N66-30214# Johann-Wolfgang-Goethe-Universitat, Frankfurt am Main (West Germany). Institut fuer Kernphysik.
DEVELOPMENT OF A SOLID-STATE DETECTOR TELESCOPE AND ITS APPLICATION FOR STUDYING THE REACTION $Si^{28}(n,p)Al^{28}$ [ENTWICKLUNG EINES HALBLEITERZAELER-TELESKOPS UND SEINE ANWENDUNG ZUR UNTERSUCHUNG DER REAKTION $^{28}Si(n,p)^{28}Al$]
W. Mausberg Dec. 1965 88 p refs In GERMAN
(IKF-14)

A telescope was developed consisting of four solid state detectors, the first of them serving as target for the reaction $^{28}Si(n,p)^{28}Al$. Angular distributions of the proton group $p_{0.1}$ emerging from the transition to the ground state doublet of ^{28}Al were measured at neutron energies of 9.1, 14.1, and 21 Mev, the neutrons having an energy spread of about 200 kev. Absolute values of the cross sections are given. The distribution at 9.1 Mev is symmetric to 90°, but cannot be described by a Hauser-Feshbach calculation. The distributions at 14.1 and 21 Mev are asymmetric; they are fitted well by DWBA calculations of Agodi and Schiffrer, if one assumes for 14.1 Mev an isotropic compound contribution of 60%.
Author (NSA)

N66-30276*# General Dynamics Corp., San Diego, Calif. Special Nuclear Effects Lab.
RADIATION EFFECTS ON SILICON Quarterly Progress Report No. 5, Jan. 1-Mar. 31, 1966
E. G. Wikner, J. A. Naber, and H. Horiye 11 Apr. 1966 14 p refs
(Contracts NAS7-289; DA-49-186-AMC-65(X))
(NASA-CR-76119; GACD-6249) CFSTI: HC $1.00/MF $0.50
CSCL 20L

The electrical conductivity for the n-type ultrapure silicon was measured from 4° to 300°K. Also, the transient conductivity was measured from 20° to 300°K at high injection levels. The results show that a quantitative determination of the temperature dependence of conductivity and transient conductivity is possible. The annealing characteristics of the divacancy formed at 80°K in p-type silicon and the vacancy phosphorus complex formed at the same temperature in n-type were studied. For the divacancy, it was observed that there is at most a 10% increase in the number of centers after a 300° anneal. This signifies that there is a very small number of indirectly produced divacancies in the 80°K in B-doped silicon. Finally, microwave resonance studies were made to identify the recombination center responsible for the lifetime degradation. D.T.

N66-30311# Library of Congress, Washington, D. C. Aerospace Technology Div.
RADIATION DAMAGE IN SOLIDS Surveys of Communist World Scientific and Technical Literature
J. Andrushis and C. Shishkevish 18 Apr. 1966 213 p Compilation of abstracts
(ATD-66-43)

Soviet-bloc open literature is reviewed for a bibliography on radiation damage in semiconductors, metals and alloys, polymers, low molecular weight compounds, lubricants, ceramics, and other materials. Abstracts are also included for devices, components, and insulating materials. It is noted that the most significant contribution by Soviet scientists in research on radiation damage in solids is the systematic study of radiation effects in semiconductors, especially germanium and silicon; and many articles relating to such research are abstracted. M.W.R.

N66-30482# Polish Academy of Sciences, Warsaw. Inst. of Nuclear Research.
ON THE POSSIBILITY OF SIMULTANEOUS STRUCTURE AND LATTICE DYNAMICS STUDIES OF SOLIDS USING THE TIME-OF-FLIGHT METHOD [O MOZLIWOSCI JEDNOCZESNEGO BADANIA STRUKTURY I DYNAMIKI SIECI KRYSTALICZNEJ PRZY UZYCIU METODY CZASU PRZELOTU]
Bronislaw Buras Mar. 1966 14 p refs
(Contract IAEA-255/RB1)
(INR-702/II/PS) CFSTI: HC $1.00/MF $0.50

The possibility of application of the time-of-flight technique to simultaneous structure and lattice dynamics studies of solids was investigated in the case of powdered crystals. A pulsed collimated polychromatic beam of neutrons from the pulsed neutron source was scattered on the powdered crystal sample surface. The neutrons elastically scattered to the left were collimated and recorded by the counter, which was connected to a multichannel time analyzer. The information provided by the time analyzer was felt to be sufficient for structure determination. It was pointed out that the proposed simultaneous measurements might be useful in studies of the relation between the structure of a solid and its lattice dynamics, especially in phase transitions and influence of external fields. L.E.W.

N66-30493# Polish Academy of Sciences, Cracow. Inst. of Nuclear Physics.
NEUTRON INVESTIGATION OF TEMPERATURE EFFECTS IN THE MAGNON SPECTRUM OF MAGNETITE [NEUTRONOWE BADANIA EFEKTOW TEMPERATUROWYCH W WIDMIE MAGNONOWYM MAGNETYTU]
Z. Dimitrijevic, J. Todorovic, (Inst. of Nucl. Sci. Boris Kidric) S. Krasnicki, H. Rzany and A. Wanic Jan. 1966 19 p refs Submitted for Publication
(Rept.-456/PS) CFSTI: HC $1.00/MF $0.50

In the work on pyrrhotite the dispersion relation of acoustic magnons and its temperature dependence was investigated. These measurements revealed that the higher energy magnons of the accoustic branch appeared to be more temperature resistant than the lower energy ones. This is in contradiction to theoretical work on magnon dispersion relation temperature dependence in ferrimagnets. It was therefore suggested that the measurements performed on magnetite should be repeated, since the resolution attainable in Vinôa was considerably higher. The work presented was done in Vinôa using the RA reactor and the Cracow Neutron Spectrometer. The experimental technique applied was essentially the same as that used during the work on pyrrhotite. Author

N66-30549# Rensselaer Polytechnic Inst., Troy, N. Y.
INVESTIGATION OF TRANSIENT RADIATION DAMAGE IN SEMICONDUCTOR MATERIALS First Quarterly Progress Report, 1 Oct.-31 Dec. 1965
John C. Corelli and A. Robb Frederickson May 1966 15 p refs *Its* Rept.-1
(Contract DA-28-043-AMC-01788(E))
(ECOM-01788-1; AD-632458) CFSTI: HC $1.00/MF $0.50

The report gives the first results of transient radiation damage experiments designed primarily to cover a wide range of electron flux ($\sim 10^5 - 10^{10}$ e/cm^2 in the pulse). The incident electron energy was 48 MeV and the electron beam pulse widths used were in the range 1 to 4.5 micro sec. The samples studied were 100 ohm -cm floating zone silicon phosphorous and indium doped. The irradiations were carried out with the sample at 100, 200 or 300°K to roughly check temperature dependence. The probes used to detect transient radiation

damage are the conductivity and Hall effect voltages. The results indicate a saturation in the Hall effect and conductivity voltage pulses for electron fluxes $\geq 10^9$ e/cm^2. Both the fractional Hall effect and conductivity voltages ($\Delta V/V$) have the same flux dependence. The main effect in transient radiation damage experiments is one of ionization and recombinations of excess electron hole pairs, and moreover transient atomic displacement damage if present is small and not detectable. Author (TAB)

N66-30599*# Virginia Univ., Charlottesville. Research Labs. for the Engineering Sciences.
A STUDY OF THIN FILM VACUUM DEPOSITED JUNCTIONS Semiannual Status Report, Dec. 5, 1965–Jun. 5, 1966
Robert L. Ramey Jun. 1966 45 p refs
(Grant NsG-340)
(NASA-CR-76202; EE-4012-106-66U) CFSTI: HC $2.00/MF $0.50 CSCL 20L

During this period theoretical and analytical research on surface and body state effects on the carrier concentration and mobility in thin films was completed. A model was developed for any electron tunneling device based on electrodes which are rough in terms of atomic lattice dimensions. The theoretical and experimental results of this investigation are discussed. R.N.A.

N66-30637# Rensselaer Polytechnic Inst., Troy, N. Y.
DYNAMIC INTERACTIONS BETWEEN MOVING DISLOCATIONS AND SOLUTE ATOMS IN DILUTE SOLID SOLUTIONS Final Report, 1 Nov. 1964–31 Oct. 1965
G. S. Ansell May 1966 7 p ref
(Grant DA-ARO(D)-31-124-G612)
(AROD-5042-1; AD-633004) CFSTI: HC $1.00/MF $0.50

The first aspect of the program concerned a theoretical model as to the effects of dilatational elastic strains upon the diffusivity of interstitial solute elements in metals. This work was extended to calculate the pipe diffusion of solute elements along edge dislocations as a function of both position within the cross section of the dislocation strain field and temperature. On the basis of this calculation, computation was made of the pickup of solute by moving dislocations in dilute solid solutions so as to be able to predict the stress-velocity relationships of dislocations in metals. The second aspect of the program concerned the development of an experimental study to determine the validity of both the general dislocation calculation and of the quantitative predictions derived. This work centered upon the design and construction of a gaseous diffusion apparatus in which the mass transport of diffusing species through metals could be quantitatively measured as a function of the defect structure contained within the metal.
Author (TAB)

N66-30638# Rensselaer Polytechnic Inst., Troy, N. Y.
DISLOCATION MOBILITY AND INTERACTIONS IN HIGH PURITY MAGNESIUM Final Report, 1 Nov. 1961–30 Oct. 1964
G. S. Ansell [1964] 6 p ref
(Grant DA-ARO(D)-31-124-G209)
(AROD-3394-3; AD-633005) CFSTI: HC $1.00/MF $0.50

A study of the effect of purity, temperature, glide plane and substructure on the mobility and interactions of dislocations in magnesium is presented. TAB

N66-30644# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1 NOVEMBER 1965–31 JANUARY 1966
Alan L. Mc Whorter 6 May 1966 76 p refs
(Contract AF 19(628)-5167)
(ESD-TR-66-42; AD-632998) CFSTI: HC $3.00/MF $0.75

Contents: Solid state device research: optical techniques and devices; materials research; physics of solids. TAB

N66-30676# New York Univ., N. Y. Dept. of Physics.
PARAMAGNETIC RESONANCE IN THE SOLID STATE Final Report, 1 Jan.–30 Jun. 1965
Hartmutt P. Kallmann May 1966 29 p refs
(Contract DA-36-039-SC-89074)
(ECOM-89074-F; AD-633240) CFSTI: HC $2.00/MF $0.50

The relationship between fluorescence, fluorescence quenching, light stimulation, glow areas, and the photo-induced EPR signals in excited Cr, Cu activated ZnS phosphors was studied. Two types of trap levels exist: deep traps due to chromium and shallow traps located in the neighborhood of ionized Cu activators; their trap populations are determined. Electrons in both types of traps respond to IR but with a quite different IR wavelength dependence. IR shifts electrons from deep to shallow levels; heating shifts them in the reverse direction. IR raises electrons from deep traps into the conductivity level and is also absorbed by the ionized activators. The latter absorption gives rise to light stimulation or quenching.
Author (TAB)

N66-30679# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
EXPERIMENTAL STUDY OF TEMPERATURE DEPENDENCE OF CHARACTERISTIC ELECTRON ENERGY LOSSES IN ALUMINUM, TIN, MAGNESIUM AND LEAD Summary Technical Progress Report
Harry J. Watson and Robert R. Mitchell Apr. 1966 40 p refs
(Contract Nonr-4549(00))
(R-196; AD-632895) CFSTI: HC $2.00/MF $0.50

The characteristic energy losses which are observed when a thin film of metal is bombarded by an energetic beam of electrons were investigated as a function of temperature from 300° C to 4.2° K. The metal examined are tin, aluminum, magnesium, and lead. The change in plasmon energy for magnesium and tin is almost linear, but the aluminum values increase rapidly below 77°K while the values for lead decrease below 77°K. The observed values are compared to those that would be expected due to a change in the free electron density caused by a thermal expansion or contraction of the sample. Values of the mean free path for plasmon production in aluminum are also presented as function of temperature.
Author (TAB)

N66-30685# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.
FIELD DEPENDENCE OF THE SPONTANEOUS MAGNETIZATION IN A HEISENBERG UNIAXIAL FERROMAGNET
S. Alexander and S. Shtrikman 15 Dec. 1965 19 p refs
(Contract AF 61(052)-654)
(TN-21; AD-632764) CFSTI: HC $1.00/MF $0.50

The field dependence of the spontaneous magnetization in a simple cubic Heisenberg uniaxial ferromagnet at 0°K is studied in the spin wave approximation. The relative change of the magnetization from the fully aligned value is largest when the applied field is equal to the anisotropy field. The deviation is $1/24\pi S(D/J)^{3/2}$ where D is the single ion anisotropy, J the exchange interaction and S the spin of the ion. The high and low field behavior of the deviation are discussed in detail. Author (TAB)

N66-30718# General Electric Co., Schenectady, N. Y. Research and Development Center.

NEW SOLID-STATE DEVICE CONCEPTS Scientific Report No. 4

M. Aven, R. N. Hall, and J. R. Richardson Mar. 1966 47 p refs *Its* Rept.-66-GC-0324

(Contract AF 19(628)-4976)

(AFCRL-66-225; AD-632779) CFSTI: HC $2.00/MF $0.50

The electrical behavior of $ZnSe_xTe_{1-x}$ light-emitting diodes is analyzed in terms of the bulk electrical properties of the n- and p-type junction components. It is proposed that the mechanism of charge transport in the diodes involves photo-excitation with subsequent minority carrier trapping, which leaves the majority carriers free to carry current. A number of device applications based on the photoexcitation and quenching phenomena observed are discussed. A study of the mechanism of oxidation of silicon shows that there are serious difficulties with the simple models that are offered to explain the observed oxidation rates and electrochemical phenomena. The energy levels and diffusion characteristics of the various defects that might be active during oxidation are discussed, and a new model for silicon oxidation is outlined. The electrical properties of diodes made from thin films of high-resistivity GaAs show both a negative-resistance and an interesting storage effect. A theory based on injected avalanche is proposed to explain the negative resistance.

Author (TAB)

N66-30720# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.

THE CRITICAL BEHAVIOR OF A WEAK FERROMAGNET

G. Gorodetsky, S. Shtrikman, and D. Treves 15 Jan. 1966. 12 p refs

(Contract AF 61(052)-654)

(TN-23; AD-632765) CFSTI: HC $1.00/MF $0.50

Measurements of the temperature dependence of the magnetization in weak ferromagnetic $YFeO_3$ along the ferromagnetic direction in the critical region, $0.996 < T/T_c < 1.003$, are reported. Analysis of the data gives the following results for the critical exponents: $\beta = 0.55 \pm 0.04$, $\gamma = 1.33 \pm 0.04$, $\gamma = 0.7 \pm 0.1$, $1/\delta = 0.36 \pm 0.03$. Author (TAB)

N66-30729# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.

TABULATION OF THE NUMBER OF INDEPENDENT COMPONENTS OF PHYSICAL TENSORS FOR THE MAGNETIC CLASSES

J. Tenenbaum 1 Oct. 1965 16 p refs

(Contract AF 61(052)-654)

(TN-18; AD-633016) CFSTI: HC $1.00/MF $0.50

A derivation is given of the number of independent components of tensors up to the 4th rank in the various magnetic classes. The method of Bhagavantam and Pantulu and extended by Lyubarskii is followed in cases of tensors having intrinsic symmetry. C.T.C.

N66-30730# Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Electronics.

INTERNAL FIELD IN ORTHOFERRITES AND THE ONE THIRD LAW

M. Eibschvetz, S. Shtrikman, and D. Treves 1 Jan. 1966 13 p refs

(Contract AF 61(052)-654)

(TN-22; AD-633015) CFSTI: HC $1.00/MF $0.50

The temperature dependence of the internal field in orthoferrites at the iron nucleus was measured using the Mossbauer effect. It was found that in the range $0.60T_N < T < 0.99\ T_N$ the internal field varies approximately as the 1/3 power of $(1-T/T_N)$. Author (TAB)

N66-30752*# Radio Corp. of America, Camden, N. J. Defense Electronic Products.

STUDY OF PROPERTIES OF HIGH FIELD SUPERCONDUCTORS, AC FIELD INDUCED FLUX JUMPS Technical Summary Report, 21 Jun. 1965-26 Apr. 1966

D. A. Gandolfo and C. M. Harper 26 Apr. 1966 71 p refs (Contract NAS8-11272)

(NASA-CR-76253) CFSTI: HC $3.00/MF $0.75 CSCL 20L

Magnetization experiments in superimposed dc and audio-frequency ac magnetic fields have been performed on tubular samples of cold worked Nb 50% Ti. The samples exhibited a dc field dependent critical-current density in agreement with Kim's equation. When an ac field whose amplitude exceeded a certain threshold was superimposed on the dc field, regular flux jumps ensued. The threshold was inversely proportional to the frequency, with the dependence being stronger at frequencies below 200 cps. At low frequencies the duration of a flux jump was estimated as 2×10^{-4} sec. The flux jumps were identical in amplitude at a given frequency and strikingly similar from 6.3 to 208 cps, the most common amplitude being in the range from 400 to 500 G. Temperature measurements made with a carbon resistor in the sample interior showed that threshold fields caused the bulk sample temperature to rise by not more than 0.1°K. This small increase is in qualitative agreement with computations of the steady-state temperature rise caused by hysteresis and eddy current losses, also found to be quite small. Author

N66-30810# Tokyo Univ. (Japan). Inst. for Solid State Physics.

ANISOTROPIC s-p INTERACTION IN RARE EARTH METALS

Tadao Kasuya and D. H. Lyons Sep. 1965 55 p refs Submitted for Publication *Its* Ser. A, No. 167

(NP-15590)

A detailed treatment of the s-f interaction, based on the free electron model, is presented, and also the fundamental method is established. The exchange part of the s-f interaction is considered, and the indirect coupling of the localized moments and lifetime of conduction electrons for the perfect paramagnetic state are calculated. The usual screened Coulomb interaction is used in treatment of direct terms in s-f interactions. NSA

N66-30847*# University of Southern Calif., Los Angeles. Dept. of Physics.

OPTICAL CONSTANTS OF SILVER AND BARIUM IN THE VACUUM ULTRAVIOLET SPECTRAL REGION

E. I. Fisher, I. Fujita, and G. L. Weissler 1 May 1966 107 p refs

(Contract NsG-178-61)

(NASA-CR-76364; USC-VacUV-108) CFSTI: HC $4.00/MF $0.75 CSCL 20L

The optical properties of evaporated silver and barium films have been investigated in the wavelength range from 1500 to 3000 Å. Reflectance measurements with unpolarized light were made at two angles of incidence, 17.5° and 72.5°, and the components of the complex index of refraction obtained from graphical solutions of the Fresnel reflection equations. The films were prepared in an ultrahigh vacuum reflectometer having a base pressure of about 5×10^{-10} torr. Radiation from a hydrogen glow discharge light source

was dispersed by a normal incidence vacuum monochromator which was optically connected to the ultrahigh vacuum system by means of a sapphire window. The energy loss functions, as computed from the optical constants, were compared with published characteristic electron loss data. The complex index of refraction of barium was fitted to a Drude model for which the plasma energy was fixed at 7.42 eV and the damping was allowed to be energy dependent. Author

N66-30888# Rensselaer Polytechnic Inst., Troy, N. Y.
NUCLEAR QUADRUPOLE COUPLING STUDIES IN SOLIDS Annual Report
Philip A. Casabella May 1965 5 p refs
(Contract AT(30-1)-3030)
(RPI-3030-3) CFSTI: HC $1.00/MF $0.50

Results of the study of the ferroelectric phase transition in Rochelle Salt are reported. The effects of a d–c electric field on a rigidly mounted Rochelle Salt crystal indicate that the rigid mounting impedes the motion of domain walls but has no effect on the phase transition. The radiation damage in $NaClO_3$ from ^{60}Co rays was found to be nearly linear (proportional to radiation intensity). Work on the nuclear quadrupole resonance of ^{14}N and on Group III halides is summarized briefly. NSA

N66-30902# California Univ., Berkeley. Lawrence Radiation Lab.
THE MAGNETIC AND ELECTRICAL PROPERTIES OF SOME METALS AT HIGH PRESSURES
David B. Phillips (Ph.D. Thesis) Aug. 1965 58 p refs
(Contract W-7405-ENG-48)
(UCRL-16299) CFSTI: HC $3.00/MF $0.50

A device for measuring low field magnetization of high permeability materials as a function of temperature and pressure in Bridgman anvils was developed. This device was used to measure the Curie point (T_c) of Gd to 20 kbars pressure and the Neel point (T_n) of Tb to 15 kbars pressure. For Gd dT_c/dP was found to be -1.9 ± 0.2°K/kbar, and dT_n/dP for Tb was measured as -1.4 ± 0.2°K/kbar. The decrease in low field magnetization with pressure was quite marked in both cases and this limited the maximum pressure obtainable. The decrease in magnetization is shown to be a result of elastic stresses and plastic deformation caused by compression. The basic system should be capable of pressures to 100 kbars and a temperature range of 65–600°K. Suggestions for reaching these conditions and extending the measurements to higher pressures for Gd and Tb are discussed. In an attempt to determine the effect alloying on the high pressure Fe phase transition, the ^{57}Fe Mossbauer spectra in two types of stainless steel were studied at high pressures. No evidence for any sharp phase transitions was found. In both samples a broad absorption superposed on the single central line was noted at high pressures. This behavior was reversible with pressure in one sample and irreversible in the second sample. Annealing restored the original spectrum of the second sample. These changes are discussed as a transition from a paramagnetic to a partially ferromagnetic structure under pressure. The electrical resistance of Bi was carefully investigated in the pressure region between 30 and 90 kbars in an attempt to locate the transitions noted as volume discontinuities by Bridgman. No discontinuities were found in the electrical resistance in this region. This does not necessarily mean that the phase changes reported by Bridgman at 45 and 64 kbar do not exist. Author (NSA)

N66-31031# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
PHOTOCONDUCTION MEASUREMENT ON DOPED MONOCRYSTALS OF CdS [MISURE DI FOTOCONDUZIONE SU MONOCRISTALLI OROGATI DI CdS]
L. Bartolini 3 Feb. 1966 10 p refs In ITALIAN *Its* Nota Interna No. 304
(LNF-66/3)

The technique used for doping semiconductor monocrystals of CdS with Cu and Ag is described. The effect of the heat treatment in sulfur and selenium vapor on the resistivity, spectral photoresponse, extinction spectrum, and on some dynamic effects under light excitation was shown. NSA

N66-31033# Illinois Univ., Urbana. Materials Research Lab.
THE SCIENCE OF MATERIALS Annual Progress Report, 1965–1966
15 Apr. 1966 69 p refs
(Contract AT(11-1)-1198)
(COO-1198-358) CFSTI: HC $3.00/MF $0.75

Brief summaries are given of the results of investigations on: dislocation and surface barriers, solid state phase trasformations, annealing of cold-worked metals, strain energy in martensitic transformations, electronic specific heat of alloys of transition elements with nontransition elements, use of very high pressure to investigate the structure of matter, first order phase transformations in solids, nuclear magnetic resonance studies, properties of noble gas crystals, properties of ^3He below 0.01°K, point defect-dislocation interactions, the impurity conduction band in Si and Ge and magneto-optic effect of the R center in KCl, conduction mechanisms in semiconducting glasses, mechanical and surface behavior of crystals, anharmonic effects in solids, defect and electronic properties of solids, electron and nuclear magnetic resonance, defects in refractory metals and alloys, and radiation damage. NSA

N66-31043# Oak Ridge National Lab., Tenn.
SOME ELECTRICAL MEASUREMENTS ON ANODIC FILMS ON ZIRCONIUM
V. A. Nicely and R. J. Davis 28 Dec. 1965 28 p refs
(Contract W-7405-ENG-26)
(ORNL-TM-1435) CFSTI: HC $2.00/MF $0.50

Two sets of experiments were performed in an investigation to find techniques to determine characteristics of oxide films on Zr which might, in turn, be related to corrosion mechanisms. An attempt was made to show the existence of a conductivity gradient in heated ZrO_2 film by a technique reported for films on Ta. This technique depends on the resistance and reactance of the film being of similar magnitude near the metal interface and requires that the conductivity of the oxide be greater than about $10^{-8} \Omega^{-1} cm^{-1}$. The a–c resistance data indicated that heating the oxide for short periods resulted in an increase in average conductivity of less than one order of magnitude. But the final conductivity was not high enough for a conductivity gradient to be demonstrated. Using various parameters from the literature it was indicated that longer heating times would probably result in the effect described but would also result in partial dissolution of the oxide. In another set of experiments, attempts were made to measure d–c resistance of anodic films on Zr using various contacts to the oxide interface. Contacts with Hg, evaporated Ag, and Ga were used. Two techniques with Ga were employed: Dipping a fresh surface into a pool of Ga and dipping a surface prepared by rubbing Ga onto the surface with a paper tissue. A–c impedances were measured using contacts of evaporated Ag, Ga, rubbed Ga and 1 *M* NH_4NO_3 electrolyte. The apparent d–c resistances

measured with Ag, Hg, or unrubbed Ga contacts drifted to higher values with time and these contacts and techniques were therefore considered not useful. The rubbed Ga contacts gave currents that did not drift. The calculated resistances obeyed ohms law and increased about linearly with film thickness. A-c impedances with the same contacts gave the frequency dependence expected from a capacitance (Cp) in parallel with resistance (Rp). The values of Rp agreed with the d-c resistances. However, resistances were much less than those exhibited by other types of contacts. Two different models are suggested: The Ga is rubbed into tiny pores, which provide a resistance parallel to the film capacitance. The film is made up of two layers; a thin, outer, high resistance layer that is penetrated by the rubbing with Ga and an inner, bulk layer which has a lower resistivity, probably due to electrons associated with anion vacancies. The rubbed Ga contact is apparently not useful for direct determination of the resistance of the complete film, but may be helpful in studying mechanisms, for instance, further study might provide proof or disproof of pores. Author (NSA)

N66-31062# Welsh Coll. of Advanced Technology, Cardiff.
THE THERMAL CONDUCTIVITY OF SEMICONDUCTORS AT LOW TEMPERATURES
S. D. Probert and C. B. Thomas Risley, United Kingdom Atomic Energy Authority, 20 Apr. 1965 36 p refs
(TRG-977) HMSO: 5s

A review is presented on the thermal conductivity of semiconductors at low temperatures in the form of skeleton outlines of arguments on the theory. Lattice vibrations, formal theory of lattice thermal conductivity, phonon-phonon scattering processes, point defect scattering, electron-phonon interactions, size effects, conduction electrons, and heat conduction by electrons are discussed. NSA

N66-31066# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
ELECTRONIC SPECIFIC HEAT OF TRANSITION METAL CARBIDES [CHALEUR SPECIFIQUE ELECTRONIQUE DE CARBURES DE METAUX DE TRANSITION]
Rolland Conte (Ph.D. Thesis—Paris Univ.) 1965 55 p refs
(CEA-R-2854)

The electronic specific heats of transitional metal carbides of varying electronic concentration (TiC, either stoichiometric or non-stoichiometric, TaC, and mixed (Ti, Ta)—C) were measured, the low temperature specific heat apparatus used is described. In one of these helium is used as the exchange gas; the other is set up with a mechanical contact. The two use a germanium probe for thermometer. Measurement of the temperature using this probe is described, as well as the various measurement devices. The results are presented in the form of a rigid band model and show that the density of the states at the Fermi level has a minimum in the neighborhood of the group IV carbides. NSA

N66-31122# Centre National de la Recherche Scientifique, Paris (France).
FAR-INFRARED SPECTRA OF CRYSTALS AND SOLIDS IN A LARGE RANGE OF TEMPERATURES Annual Summary Report No. 3, 1 May 1964-30 Apr. 1965
J. Lecomte and A. Hadni 31 May 1965 31 p refs
(Contract AF 61(052)-518)
(AFCRL-65-623; AD-622091)

Far-infrared absorption spectra were obtained of thallium halides, copper halides, rare earth fluorides, dysprosium gallate B_2O_3, quartz. Reflexion spectra of ZnTe, CdTe, YnSe, thallium halides and copper halides were obtained at room temperature, liquid nitrogen, liquid hydrogen and liquid helium temperature from 40 to 900μ. The different behavior of crystals and glasses in the far-infrared at low temperature and the evidence of single phonon processes in glasses and ionic crystals is considered. Author (TAB)

N66-31158*# Rose Polytechnic Inst., Terre Haute, Ind.
NOTES ON THE SPIN-HAMILTONIAN
H. A. Sabbagh *In* NASA. Goddard Space Flight Center ASEE-Univ. of Md.-Catholic Univ. NASA Summer Fellowship Program Jan. 1966 p 63-76 refs (See N66-31154 17-07)
CFSTI: HC $4.00/MF $0.75

The behavior of a paramagnetic ion interacting with its crystal lattice in an applied dc magnetic field is theoretically described by a function of the total spin resulting from unpaired electrons within the ion; empirically determined constants are used. Two specific examples are presented as a means of surveying the theory of spin hamiltonian formalism: (1) F^{+++} imbedded in TiO_2; and (2) Ho^{++} imbedded in CaF_2. D.T.

N66-31173# Mithras, Inc., Cambridge, Mass.
TRANSITION METALS IN $LaAlO_3$ Scientific Report No. 1
Charles S. Naiman, Jack Schwartz, and Arthur Linz Jul. 1965 31 p refs
(Contract AF 19(628)-4006)
(MC-64-102-RI; AFCRL-65-619; AD-623121) CFSTI: HC $2.00/MF $0.50

Optical absorption and EPR studies have been made of Cr and Co in $LaAlO_3$ grown by flame fusion. Crystal field values have been established as follows: Dq/B = 3.18 for Cr(3+), 0.965 for Co (2+), and 3.08 for Co(3+) in $LaAlO_3$. Local site symmetries for the two dopants, as observed by EPR, are discussed. Author (TAB)

N66-31280# Delaware Univ., Newark. Dept. of Physics.
ELECTRICAL CONTACTS TO CADMIUM SULFIDE SINGLE CRYSTALS
Robert Burton Hall (M.S. Thesis) Jun. 1966 71 p refs
(Contract Nonr-4336(00))
(AD-632826) CFSTI: HC $3.00/MF $0.75

It is well known that at room temperature ohmic-behaving electrical contacts to CdS single crystals can easily be attained. However, at temperatures greater than 100°C such contacts exhibit instability (e.g., diffusion of indium into the bulk of the crystal above 100°C where, acting as a donor, it may dominate crystal behavior). A multilayer technique has been developed which permits evaporated electrodes to perform ohmically up to 300°C. This technique is characterized by the usage of a preparative metal to clean the surface of the crystal to be electroded, an active metal to serve as the ohmic-behaving electrical contact, and a covering metal to carry current and act as a diffusion sink. Although in half the cases a heat treatment of the multilayer-crystal system is necessary to create an ohmic-behaving contact, the results using titanium as the preparative metal and aluminum as the active metal have been completely successful. Author (TAB)

N66-31301# Army Foreign Science and Technology Center, Washington, D. C.
EFFECT OF GAS SORPTION ON PHYSICAL PROPERTIES OF CdSe FILMS

J. Viscakas and A. Medeisis 4 May 1966 16 p refs Transl. into ENGLISH from Vilna Univ., Mokslo Darbai (Lithuanian SSR), v. 33, n. 9, 1960
(FSTC-HT-23-82-66; AD-633207) CFSTI: HC $1.00/MF $0.50

The films studied in the experiment were produced by vaporizing CdSe in vacuum on a glass base or on the bottom of a Diuar container with the help of electrodes. The study pertained to the effect of oxygen, hydrogen, nitrogen and air sorption on the electrical conductivity of CdSe layers. It was determined that oxygen has the greatest effect on changes in the electrical conductivity of CdSe layers. The specific resistance, changes in electrical conductivity, as well as changes in relative photo-sensitivity in the air depend on the thickness of the layer. Production conditions and the thickness of the film also determine the constant K. It was also shown that at low temperature, activating energy is lower in a vacuum than in oxygen, while pure nitrogen has no effect on it. Author (TAB)

N66-31303# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
MAGNETO-OPTIC ELLIPSOMETRY. PART II: THE EXPERIMENTAL APPARATUS
Axel M. Stoffel and Karl Strnat Mar. 1966 23 p ref
(AFML-TR-64-419, Pt. II; AD-633011) CFSTI: HC $1.00/MF $0.50

Part I of this report describes the phenomenology and theory of the magneto-optic Kerr effect. This second part describes the design of an electronic polarimeter for the detection and measurement of small changes in the orientation of linearly polarized light with the precision of a few seconds of arc. The procedure for the measurement of the complex index of refraction and the magneto-optic Kerr effect of ferromagnetic materials is discussed. Author (TAB)

N66-31328# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.
PAIR CORRELATIONS IN LIQUID AND SOLID ALUMINUM Technical Report No. 9
R. R. Fessler, Roy Kaplow, and B. L. Averbach 29 Apr. 1966 37 p refs
(Contract Nonr-1841(48))
(DSR-7954; AD-633052) CFSTI: HC $2.00/MF $0.50

Radial density function were determined by X-ray diffraction for solid aluminum at 25°, 325°, and 655°C and for liquid aluminum at 665° and 750°C. The first ten coupling factors, averaged for the three temperatures, were 0.70, 0.73, 0.92, 0.90, 0.82, 0.83, 1.00, 0.96, 0.93, 0.93. The radial density functions of liquid aluminum at 665° and 750°C were quite similar. Liquid aluminum has the same basic structure as liquid lead, but a different structure than liquid mercury. Comparisons with the random packing model showed that this model does not reproduce the details of the measured radial density function. A quasi-crystalline model, in which the radial density function of the solid is broadened and damped by the introduction of a cell size and liquid diffusive motions, agreed quite well with the experimental density function. A tunnel model, in which atoms move freely in tunnels arranged in a two-dimensional close-packed network also fitted quite well, but a large number of free parameters is required.
Author (TAB)

N66-31338# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
QUANTUM THEORY OF MOBILITY IN DOPED SEMICONDUCTORS
Elvin James Moore Mar. 1966 192 p refs
(Contract ARPA SD-88)
(ARPA-24; AD-632935) CFSTI: HC $5.00/MF $1.00

Existing quantum transport theories relevant to the problem of electron mobility in semiconductors due to ionized impurity scattering problem are extended and simplified to obtain a mobility formula, valid for weak impurity potentials, which includes corrections due to coherent scattering from groups of impurities. Author (TAB)

N66-31366*# Melpar, Inc., Fall Church, Va.
AMORPHOUS SEMICONDUCTOR Seventh Quarterly Report, 3 Feb.–2 May 1966
William Zimmerman, III [1966] 26 p refs
(Contract NASw-934)
(NASA-CR-76387) CFSTI: HC $2.00/MF $0.50 CSCL 20L

It is reported that ultra-pure boron thin films have been obtained and data is presented from the measurements of the absorption spectra of these films. Samples of the absorption curves obtained are included and some features of the spectrum are noted. A possible qualitative explanation of the observations made is offered. A summary is also provided of studies of the structure of amorphous thin films. H.S.W.

N66-31369*# Chicago Univ., Ill.
"S-D" EXCHANGE MODEL OF ZERO-BIAS TUNNELING ANOMALIES
J. Appelbaum [1965] 18 p refs
(Grant NsG-352)
(NASA-CR-76390) CFSTI: HC $1.00/MF $0.50 CSCL 20L

The results of several experiments are discussed in which anomalies in the tunneling conductance centered at zero bias were observed; the studies centered on several p–n junctions, and junctions of normal metals separated by an insulating oxide layer. Theories, advanced to explain the anomalies, are considered. Based on the suggestion that they were caused by magnetic impurities, several microscopic mechanisms were analyzed. It is pointed out that at near zero bias and low temperatures localized states can be expected to contribute to the tunneling current by serving as a momentum reservoir for the tunneling electrons; this reservoir is essential if the initial and final states of the tunneling electron have wave vectors differing by a substantial fraction of a reciprocal lattice vector. In formulating the problem it is assumed that the localized states associated specifically with impurities or with the metal-oxide interface are paramagnetic and are coupled to the conduction electrons by an exchange interaction. Equations are derived for this interaction. It is assumed that localized spin state may neglected. figures depict the typical scattering processes which contribute to ΔG, and analysis of these processes is presented. M.G.J.

N66-31373*# Stanford Univ., Calif. Solid-state Electronics Labs.
FUNDAMENTAL STUDIES OF THE METALLURGICAL, ELECTRICAL, AND OPTICAL PROPERTIES OF GALLIUM PHOSPHIDE Quarterly Progress Report, Apr. 1–Jun. 30, 1966
G. L. Pearson [1966] 28 p refs
(Grant NsG-555)
(NASA-CR-76395) CFSTI: HC $2.00/MF $0.50 CSCL 20L

Summaries are presented of research in the following areas; the chemical, electrical, and optical properties of cobalt as an impurity in GaP; the preparation and characterization of rectifying junctions in GaP and $GaAs_xP_{1-x}$; the semiconducting properties of GaP; and the behavior of shallow donors in GaP. H.S.W.

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N66-30257*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

POTENTIAL OF LIQUID-METHANE FUEL FOR MACH-3 COMMERCIAL SUPERSONIC TRANSPORTS

John B. Whitlow, Jr., Joseph D. Etsenberg, and Michael D. Shovlin Washington, NASA, Jul. 1966 43 p refs
(NASA-TN-D-3471) CFSTI: HC $2.00/MF $0.50 CSCL 21D

The advantages which might be obtained by using liquid-methane instead of conventional kerosene-type JP fuels in fixed arrow wing supersonic transports were studied. Afterburning turbojets were used as the propulsion system. It was calculated that a payload improvement of about 18% and a direct operating cost drop of 15–27% could be obtained by utilizing only the additional heating value of methane. By using the higher heat sink also, a total payload improvement of about 31% and an operating cost drop of as much as 36% might be achieved. The fixed arrow wing airplane was sized with large wings in order to obtain adequate takeoff and landing performance characteristics. Airplanes with wing loadings of the order of 100 lbs/sq ft suffered severely from volume limitations. It appeared that the most striking gains can be obtained with low-wing-loading vehicles. Additional advantages are identified as: elimination of coke and smoke formation; lower radiant heat transfer to the combustor linear; possible elimination of lacquer formation in the oil-fuel heat exchanger; and possible weight reduction from shorter combustors. N.E.N.

N66-30301# Aeronautical Research Associates of Princeton, Inc., N. J.

STATISTICAL MECHANICAL THEORY OF DENSE PLASMAS Interim Scientific Report, 1 Jul. 1964–30 Jun. 1965

Guido Sandri, Roger D. Sullivan, Arnold Kritz, and Frederick Schatzmann Wright-Patterson AFB, Ohio, ARL, Jan. 1966 283 p refs
(Contract AF 33(615)-1910)
(ARAP-74; ARL-66-0009; AD-631992) CFSTI: HC $6.00/MF $1.50

The physical and mathematical tools are developed for the analysis of the behavior of plasmas for which the given Bogolubov conditions do not hold. The higher order terms in these conditions for all observable quantities depend on three- and four-body correlations. The authors show that a direct calculation with Bogolubov's technique leads to divergent results. They introduce a method believed to be a far-reaching generalization of Bogolubov's. The emphasis of the classical analysis, in terms of sharply localized particle collisions, is shifted by the method to an analysis of the time scales on which the phenomena evolve. This shift leads to a new view of kinetic equations. An analysis is given of the three-body correlations which relies on the solution of the three-body problem for hard spheres. They also obtain in closed form the nth order term in the Bogolubov expansion. They then introduce an externally controlled test particle in order to probe into the properties of these correlations and to develop rigorously the corresponding statistical theory. As an application of their theory, they obtain the complete solution for the lowest order distribution function in one dimension which coincides exactly with the non-linear Debye-Huckel theory. Next they prove that three-body correlations appear one order sooner than when the test particle is absent. The transition to the macroscopic (or fluid) description is carried out by an appropriate expansion, and they give the transient behavior of the important moments. Finally, the techniques presented are utilized to discuss correlation functions among many particles. TAB

N66-30302# Texas Univ., Austin.

RESEARCH ON PLASMA DIAGNOSTIC METHODS FOR HIGH TEMPERATURE PLASMA RESEARCH Ninth Quarterly Report, 1 Apr.–30 Jun. 1965

Arwin A. Dougal, Robert F. Gribble, Marion O. Hagler, David J. Mayhall, Howard N. Roberts et al Wright-Patterson AFB, Ohio, ARL, Dec. 1965 78 p refs
(Contract AF 33(615)-3224)
(ARL-65-270; AD-631993) CFSTI: HC $3.00/MF $0.75

Investigations on the utilization of a HeNe 3.39 micron infrared maser for experimental time-space resolved diagnostics of highly transient, extreme temperature, deuterium plasmas are reported. The infrared maser coupled resonator technique for measurement of electron density was extended such that usful data were obtained for a theta-pinch plasma source operating at 50 Kg compression with 4 and 6 Kg reverse bias magnetic fields at 0.1 Torr initial pressure. Measurement of the magnetoplasma Faraday rotation of the plane of polarization of the He-Ne maser infrared radiation by the use of an infrared polarization analyzer was extended and uncertainties in the measurements were reduced. The determination of electron density provided further information for obtaining time-space resolved plasma magnetic fields from the Faraday rotation data. Resonant operation permits investigation of the low density plasma sheaths surrounding the dense core of the theta-pinch. An equation for the efficiency of a plane echelette diffraction grating is developed from the vector Kirchoff integral equation for the electric field by making an approximation for the electric and magnetic fields at the surface of the grating. TAB

N66-30304*# National Bureau of Standards, Boulder, Colo. Cryogenics Div.

QUALITY DETERMINATION OF LIQUID-SOLID HYDROGEN MIXTURES

D. E. Daney and D. B. Mann 21 Mar. 1966 71 p refs
(NASA Order W-12165; NBS Proj. 31505-12-3150450)
(NASA-CR-76137; NBS-9189) CFSTI: HC $3.00/MF $0.75 CSCL 20I

A theoretical and experimental investigation of the feasibility of predicting the quality of liquid-solid hydrogen mixtures from the mass fraction of vapor pumped off in the freeze-thaw process has been completed. Three independent methods of experimental quality determinations were used to check the correctness of the qualities predicted from the measured mass fraction pumped off in forming liquid-solid mixtures. In all cases only freshly made mixtures were used. It is suggested that an independent means of determining the edge of the triple point region, such as measurement of the vapor pressure, be used. With this modification, measurement of the mass fraction pumped off during the freeze-thaw process provides a simple nondestructive and accurate method of bulk quality determination. The method is not appropriate for cases in which a partial transfer from the dewar is made and it requires accurate knowledge of the heat leak if long storage times are to be used. Finally, since the method is only as accurate as the accuracy of the flow and liquid volume measurements, possible low accuracy in large volume gas flowmeters places a restriction on the method. Author

N66-30615*# Mathematical Sciences Corp., Seattle, Wash.
FLEXIBLE CASE ANALYSIS FOR COMPRESSIBLE SOLID PROPELLANT GRAIN MOTORS Status Report
Samuel W. Key Apr. 1966 25 p
(Contract NAS7-242)
(NASA-CR-76229; MSC-66-21-1) CFSTI: HC $1.00/MF $0.50 CSCL 21I

The stiffness version of the finite element method is used for a flexible numerical analysis of the small elementary regions of solid propellant grains. Similar to the Ritz method, the stiffness variations analyzes grain regions independent of the total configuration and combines the results to determine the response of the total configuration. An equivalent variational principle replaces conventional equilibrium equations and stress boundary conditions. For a plane strain problem and an axisymmetric elasticity problem, triangular rings are used; in the axially symmetric shell problem, line elements are employed. While the theory underlying the stiffness method is sufficiently general to include three-dimensional problems, the current practice is to utilize two-dimensional problems because programming and computer capacity is generally unavailable for the former. Details are included for both a plane strain problem and an axisymmetric problem bounded by a flexible case. M.W.R.

N66-30739# Bureau of Mines, Bruceton, Pa. Explosives Research Center.
IGNITION CHARACTERISTICS OF FUELS AND LUBRICANTS Technical Report, 1 Jan. 1963–31 Dec. 1965
Joseph M. Kuchta, Ralph J. Cato, George H. Martindill, and Whittner H. Gilbert Wright-Patterson AFB, Ohio, AF Aero Propulsion Lab., Mar. 1966 83 p refs
(AFAPL-TR-66-21; AD-632730) CFSTI: HC $3.00/MF $0.75

The combustibles included n-hexane, n-octane, n-decane, JP-6 jet fuel, aircraft engine oil MIL-L-7808, and other hydrocarbon materials. Expressions based on thermal ignition theory are given which correlate minimum autoignition and wire ignition temperatures of the combustible vapor-oxidant mixtures as a function of the heat source dimensions, oxygen concentration, ignition delay, and initial mixture temperature (in wire ignitions). The ignition temperatures increased consistently with decreasing heat source diameter or surface area. Hot gas ignition temperatures determined for the combustibles with various size jets of hot air also varied with heat source diameter; they tended to approximate the hot surface ignition temperatures when the size of the heat source and ignition criterion were the same. Jet temperatures required to produce hot flames and luminous or cool flame reactions were also compared. In oxidation rate studies at reduced pressures with JP-6 and n-octane vapor-oxygen-nitrogen mixtures, the critical pressures for cool flame reactions increased with decreasing vessel size, temperature, oxygen concentration, and fuel concentration. In flammability studies with hydrocarbon fuel vapor-air mixtures, the upper limits of flammability are shown to increase markedly with increasing temperature, particularly in the case of the high molecular weight paraffins. TAB

N66-31138# Naval Radiological Defense Lab., San Francisco, Calif.
THE RADIOLYTIC DECOMPOSITION OF HYDROZINE, RP-1, AND HYDYNE ROCKET FUELS
W. E. Shelberg 6 Mar. 1966 17 p refs
(USNRDL-TR-1002; AD-6322461) CFSTI: HC $1.00/MF $0.50

One-hundred-milliliter samples of the storable liquid rocket fuels hydrazine, RP-1, and Hydyne generate, respectively, 89.1, 50.3 and 149.4 ml of radiolytic off-gas (measured at 25°C and 1 atm) when irradiated to 86,000,000 rads with gamma rays. When approximately 5 wt-% of an efficient, olefinic, free-radical scavenger is added to the samples, the off-gas volume produced by RP-1 fuel is reduced by 18.7% while those of hydrazine and Hydyne fuels are not reduced. These scavenging effects show that RP-1 fuel decomposes radiolytically by both free-radical (18.7%) and molecular mechanisms, and that hydrazine and Hydyne fuels decompose entirely by a molecular or ionic mechanism. Author (TAB)

N66-31316 Institute of Modern Languages, Inc., Washington, D. C.
THAT THE FUEL BE PURE
V. N. Zrelov and K. V. Rybakov May 1966 3 p Transl. into ENGLISH from Vestn. Proti Vouosdushnoy Oborony, Krasnaya Zvesda (Moscow), no. 1, 1966 p 83–84
(Contract DA-44-009-AMC-1563(T))
(T-1843-66; TT-66-61378; AD-633413) CFSTI: HC $1.00/MF $0.50

Fuel pollution during transportation, storing, filling, and in aircraft tanks, and ways of decreasing the polution are reviewed. Fuel purity was found to be higher in the central climates than in the southern zones. The problem areas are identified as corrosion from transport and storage tanks and mechanical admixtures from ambient air during the open-air filling of tanks. Improved filters and a closed method for filling tanks are mentioned. To reduce impurities in the aircraft tanks during operation, a plan is suggested to bypass the fuel-oil radiator to avoid repeated heating. N.E.N.

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N66-30041# Purdue Univ., Lafayette, Ind. School of Mechanical Engineering.
PARAMETRIC STUDY OF ROCKET INSTABILITY Final Report
J. R. Osborn 10 Jan. 1966 7 p refs
(Grant AF-AFOSR-753-65)
(AFOSR-66-0696; AD-632087) CFSTI: HC $1.00/MF $0.50

The research program was concerned with the determination of those dimensionless parameters that may be employed as criteria for predicting the stability of combustion in a thrust chamber. These dimensionless parameters are related to physical and chemical variables which are available to the design engineer. Both analytical and experimental work were performed to enable the prediction of combustion pressure oscillations and, therefore, avoid them in actual rocket engine design. Author (TAB)

N66-30300*# Brown Engineering Co., Inc., Huntsville, Ala. Research Labs.
A FORTRAN PROGRAM FOR HEAT TRANSFER ANALYSIS OF THE J-2 ENGINE

J. G. Floyd, B. G. Smith, and H. H. Seidel Mar. 1965 107 p refs
(Contract NAS8-5289)
(NASA-CR-67353; R-127) CFSTI: HC $4.00/MF $0.75 CSCL 21H

This report describes an IBM 7040 FORTRAN computer program for determining the heat transfer and pressure drop across the jacket of the regeneratively cooled J-2 engine. Thermochemical and heat transfer analyses were performed and are provided in two separate decks, "Thermochemical Analysis Program of the J-2 Engine", Program No. SP-172, and "Heat Transfer Computation Program of the J-2 Engine", Program No. SP-173. The entire program is incorporated in "A FORTRAN Program for Heat Transfer Analysis of the J-2 Engine", Program No. SP-148. Author

N66-30339*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LOCALIZED OVERHEATING IN AEROBEE REGENERATIVELY COOLED THRUST CHAMBERS
Jon R. Busse and Paul S. Bushnell, Jr. Mar. 1966 31 p ref
(NASA-TM-X-55516; X-721-66-146) CFSTI: HC $2.00/MF $0.50 CSCL 21H

Localized overheating, and in several cases, a burn-through, has occurred in the convergent section of the thrust chamber nozzle of the regeneratively cooled Aerobee sounding rocket engine. Examination of recovered thrust chambers and other analysis indicates that the overheating was probably due to the cross section configuration and depth of the helix in the regenerative cooling system and associated manufacturing tolerances. Because of the cost of changing this configuration and conducting static firings to qualify the new design, it was decided instead to apply more stringent manufacturing tolerances, which should reduce the probability of burn-through. Author

N66-30398*# Bell Aerosystems Co., Buffalo, N. Y.
EXPERIMENTAL AUXILIARY ROCKET ENGINE, PART I: Final Report
5 Jan. 1966 429 p *Its* Rept.-8374-933004
(Contract NAS7-305)
(NASA-CR-76150) CFSTI: HC $7.29/MF $2.00 CSCL 21H

A summary of the technical progress made in the design of a thrust chamber that could be applied to various reaction control and spacecraft maneuvering systems is presented. The concept selected was the adiabatic insulated refractory metal wall engine, utilizing a bipropellant valve; the propellant combination selected was N_2O_4MMH. This summary includes discussions in the areas of: chamber design concepts and analysis; dynamic behavior analysis; propellant selection; injector design concepts and hardware; material and coating evaluation; insulation evaluation; propellant valve design; prototype engine design; throttling investigations; and test cell buildup and test structural modification. Photographs and design drawings amplify the text. H.S.W.

N66-30399*# Bell Aerosystems Co., Buffalo, N. Y.
EXPERIMENTAL AUXILIARY ROCKET ENGINE, PART II Final Report
5 Jan. 1966 195 p *Its* Rept.-8374-933004
(Contract NAS7-305)
(NASA-CR-76155) CFSTI: HC $5.00/MF $1.25 CSCL 21H

Results are presented and assessed from the tests conducted on the two prototype engines developed during this program. It is stated that although the objectives of the program were not fully attained, an engine design concept was analytically determined which satisfies a wide spectrum of applications in reaction control and spacecraft maneuvering systems. The test data obtained are provided, and recommendations for further study are made. H.S.W.

N66-30507# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
IMPULSE OF REACTIVE FORCE OF SOLID PROPELLANT ROCKETS
Ya. B. Zel'Dovich, M.A. Rivin, and D. A. Frank-Kamenetskiy 31 Jan. 1966 194 p refs Transl. into ENGHISH of the book "Impul's Reaktivnoy Sily Porokhovykh Raket" Moscow, 1963 p 1–19.
(FTD-MT-65-244; AD-632233) CFSTI: HC $5.00/MF $1.00

The book is devoted to thermodynamic theory of calculating the impulse of reactive force of a solid propellant rocket. In it there is presented the thermodynamics of powder gases, thermodynamic calculation of a solid propellant rocket, methods of measurement of specific impulse and calculation of its magnitude for powders of different caloric value. Consideration is given to heat transfer in a solid propellant rocket, the influence of conditions of ignition of the propellant on the magnitude of the specific impulse, reasons for scattering of the magnitude of the specific impulse and methods of measuring this scattering, and the efflux coefficient. The book is designed for scientists and engineers, specializing in the area of rocket technology. Author (TAB)

N66-30626# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ROCKET-BLAST-RESISTANT MATERIALS: ROCKET ENGINE BLAST TESTS ON EXPEDIENT SURFACING MATERIALS
Grady W. Leese Apr. 1966 31 p *Its* Misc. Paper No. 4-804 (Rept.-1; AD-633264) CFSTI: HC $2.00/MF $0.50

Blasts tests with a 500-lb-thrust rocket engine were conducted on (a) ceramic-coated aluminum blast panels, (b) steel panels, (c) plastic panels, and (d) nylon membrane with and without a heat-resistant coating to determine the capabilities of these items to withstand the high temperatures and velocities generated during the firings. Based on results obtained in this investigation, the following conclusions are believed warranted: (a) The steel panels without protective coating will withstand exposure to higher blast temperatures than will the ceramic-coated aluminum panels. (b) The ceramic coating on the aluminum panels and the heat-resistant coating on the nylon membrane greatly increase the capabilities of these items to resist the rocket engine exhaust blasts. (c) The plastic panels sustained considerable damage during exposure for 20 sec to the full-stage blast of the model engine. Author (TAB)

N66-30758*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
OPTIMIZATION OF SYSTEM OPERATING PARAMETERS FOR HEAT STERILIZABLE LIQUID PROPULSION SYSTEMS
Howard D. Curtis and Allen D. Harper 1 Jun. 1965 35 p ref
(Contract NAS7-100)
(NASA-CR-76318; JPL-TM-33-211) CFSTI: HC $2.00/MF $0.50 CSCL 21H

As a means of attaining a sterile spacecraft, design information is required for liquid propulsion systems which can be heat sterilized in the loaded condition without venting. An analysis was performed to determine the values of the system operating parameters which minimize the system mass. Results are presented for both internally and externally pressurized tankage systems. The tankage mass for sterilizable

systems is approximately twice that for nonsterilizable systems. This will mean an increase of 5 to 10% in propulsion system mass for typical applications. The tankage mass is minimized when the tank is 60 to 70% filled with propellants (prior to heating) in the externally pressurized case and approximately 40% filled in the internally pressurized case. Author

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N66-30034# Oslo Univ., Blindern (Norway). Dept. of Astrophysics.

RESEARCHES IN SOLAR PHYSICS DURING 1965

Eberhart Jensen 31 Jan. 1966 39 p refs

(Contract AF 61(052)-743)

(AFCRL-66-258; AD-632171) CFSTI: HC $3.60/MF $0.50

Report on work at Oslo solar observatory during 1965 on burst phenomena, solar spectroscopy and sunspot structure. Author (TAB)

N66-30124*# Chicago Univ., Ill. Enrico Fermi Inst. for Nuclear Studies.

A CALCULATION OF THE FLUX AND ENERGY SPECTRUM OF SECONDARY ELECTRONS AT HIGH ALTITUDES IN THE ATMOSPHERE

Satya Dev Verma May 1966 45 p refs

(Grant NsG-144-61)

(NASA-CR-76099; EFINS-66-44) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Calculations are carried out to determine the flux and energy spectra of secondary electrons which are produced by the cosmic radiation in the upper layers of the atmosphere. The calculations are valid to an atmospheric depth of about 10 g/cm^2. Electron spectra are presented for different depths and locations where measurements of the electron flux have been carried out: Ft. Churchill, Manitoba; Sioux Falls, South Dakota; Palestine, Texas; and Hyderabad, India. The calculations are compared with observed electron fluxes during the ascents of balloon flights. Author

N66-30156*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PARTICLES AND FIELDS RESEARCH Bibliography with Author Index, Jan. 1958–May 1966

Wilmot N. Hess and Gilbert D. Mead, comp. Washington, NASA, 1966 173 p refs

(NASA-SP-7026) CFSTI: HC $2.50/MF $0.50 CSCL 20H

An annotated bibliography is presented for rocket and satellite research on energetic particles and on magnetic and electric fields. The material is organized into the following areas: (1) solar wind, comets, and interplanetary medium; (2) interaction of solar wind with earth, moon and planets; (3) radiation belts—experimental, and radiation belts—theoretical and survey papers; (4) artificial radiation belts—Argus and Starfish; (5) auroras; (6) solar cosmic rays; (7) galactic cosmic rays—composition and spectra of primaries; (8) galactic cosmic rays—origin, modulation, miscellaneous; (9) geomagnetism and the magnetosphere; (10) the geomagnetic tail; (11) neutrons; and (12) general. An author index is also included. D.T.

N66-30334*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ELECTRONS IN THE VAN ALLEN ZONE MEASURED WITH A SCINTILLATOR ON EXPLORER XIV

G. Pizzella, L. R. Davis, and J. M. Williamson Mar. 1966 46 p refs

(NASA-TM-X-55511; X-611-66-112) CFSTI: HC $2.00/MF $0.50 CSCL 20H

The energy spectrum of electrons in the energy range from .5 to 160 KeV was investigated near the equator, at L shells between 2 and 10, by using scintillator measurements on Explorer XIV. The following results were obtained: (1) peak values of 8×10^8 electrons/cm^2/sec with an average energy of ~50 keV at L~5; (2) peak values of 1.6×10^9 electrons/cm^2/sec with an average energy of ~10 kev at L≥8; (3) time variations of intensity by factors of 10 or less above L~4 during the 15 days of data under study; and (4) discontinuity of the energy spectrum at L~7, with a general tendency for the spectrum to become softer at higher L. The 10-keV electrons measured at L~8 are trapped in the earth's field and appear not to be a tail of the outer belt electrons. These electrons are unable, without an accompanying replenishing mechanism, to supply the auroral regions. Author

N66-30336*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

PROPAGATION OF COSMIC RAY NUCLEI IN COSMIC RAY SOURCES, INTERSTELLAR SPACE AND SOLAR SYSTEM

N. Durgaprasad Mar. 1966 32 p refs

(NASA-TM-X-55513; X-611-66-114) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Simultaneous intensity measurements of protons, helium, and heavy nuclei can be used to describe the effects on the source energy spectrum of solar modulation and diffusion occuring in source regions and in interstellar space. The energy spectra of heavy nuclei ($Z\geq10$) have been determined in the energy region 200–700 meV/nucleon for the year 1961 and compared with similar data obtained for protons, α-particles, and heavy nuclei during the years 1961 and 1963. These results have indicated that the observed intensities could be adequately explained by the following: (a) the modulating mechanism as described by a model given by Parker compared with the electric deceleration model of modulation, (b) a source differential rigidity or total energy spectrum rather than a kinetic energy spectrum having an exponent of 2.35 (as derived from experimental data available in the high energy range 10^{10}–10^{14} eV/nucleon, that is little affected by solar modulation) and (c) a path length of interstellar matter traversed that is decreasing or constant with decreasing energy for energies ≤ 15 GeV/nucleon. Author

N66-30347*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE SOURCE SPECTRA AND COMPOSITION OF COSMIC RAYS IMPLIED BY AN ANALYSIS OF INTERSTELLAR AND INTERPLANETARY TRAVEL

C. E. Fichtel and D. V. Reames Apr. 1966 58 p refs

(NASA-TM-X-55524; X-611-66-164) CFSTI: HC $3.00/MF $0.75 CSCL 20H

The implications of a simple set of assumptions related to galactic cosmic rays are examined and compared to the existing data. The results show that within the present uncertainties of the experimental data and of the interaction cross sections, the data agree with the predictions without additional assumptions if the differential source spectra are relatively flat at low energies and the average interstellar mean free path is 2.8 ±0.4 g/cm^2. In particular, the nearly

constant relative abundances of the helium, medium ($6 \leq Z \leq 9$), and ($Z \geq 10$) nuclei with energy/nucleon can be explained, and the observed variation of the light to medium nuclei flux ratio with energy/nucleon can be brought into fair agreement with predictions. The calculations also imply that, if the analysis does represent the true situation, then there is little or no solar modulation of the cosmic rays near solar minimum, and protons and helium nuclei have different source spectra. Author

N66-30351*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

QUASI-BIENNIAL VARIATIONS OF COSMIC-RAY INTENSITIES

Kaichi Maeda and T. Suda (Meteorol. Res. Inst.) Apr. 1966 33 p refs Submitted for Publication

(NASA-TM-X-55528; X-640-66-174) CFSTI: HC $2.00/MF $0.50 CSCL 20H

Owing to the atmospheric temperature effect on cosmic-rays, the so-called quasi-biennial (or 26-month) oscillation in the stratosphere should be apparent in the hard component of cosmic-ray data at the ground. As it is estimated theoretically, the cosmic-ray muon data near the equator (Lae, 8°44" S) shows a significant biennial variation, the period of which seems longer than 26 months, but shorter than 30 months for 1954–1964. The previous power spectrum analysis of Huancayo (12° S) ion-chamber data (Maeda and Suda) is also elaborated by choosing the five highest counting days in each month, indicating a significant peak at the period of 24 months. A similar analysis made for the ion-chamber data from Godhavn (69° 5"N) shows a very weak peak at 24 months for 1947–1959. It is concluded from present analyses that biennial variations in cosmic-ray intensity are predominantly of terrestrial origin, i.e., if the days of large extraterrestrial modulation (such as geomagnetic disturbed days) are chosen no significant 26-month variation appears in cosmic-ray data. Author

N66-30591*# State Univ. of Iowa, Iowa City. Dept. of Physics and Astronomy.

THE TEMPORAL VARIATIONS OF ELECTRON INTENSITIES AT LOW ALTITUDES IN THE OUTER RADIATION ZONE AS OBSERVED WITH SATELLITE INJUN 3 Progress Report, Jan. 1–Jul. 31, 1963

John D. Craven Apr. 1966 83 p refs *Its* Rept.-66-12 (Grant NsG(T)-6; Contracts Nonr-1509(06); Nonr-93803) (NASA-CR-76252) CFSTI: HC $3.00/MF $0.75 CSCL 20H

Temporal variations of the intensities of electrons ($E > 40$ keV, >230 keV, >1.6 MeV) trapped in the outer radiation zone in the region $3.0 \leq L \leq 6.0$ and mirroring at altitudes of ~ 1500 km have been studied from January 1 to July 31, 1963, by means of three Geiger–Mueller tubes on-board the satellite Injun 3. From observations during some twenty geomagnetically distrubed periods, it is shown that the largest intensity variations occur at the onset of such disturbances and that subsequent behavior is dependent on the magnitudes of the disturbances as measured by the maximum daily sums of the planetary magnetic disturbance parameter, K_p. The time histories of these intensity variations are compared with those of 3-hour averages of the horizontal component of the geomagnetic field at College, Alaska ($L = 5.5$), for several disturbed periods. Author

N66-30735# Colorado Univ., Boulder.

SOLAR ULTRAVIOLET AND ATMOSPHERIC COMPOSITION RESEARCH Final Report, 1 Feb. 1962–31 Mar. 1965

William A. Rense and Fred C. Wilshusen Mar. 1966 24 p refs (Contract AF 19(628)-287)

(AFCRL-66-144; AD-632703) CFSTI: HC $1.00/MF $0.50

Both solar radiation and atmospheric composition are most important physical aspects of the solar system which influence our environment. The theoretical concepts concerning the solar system must be adequately supported by experimental data. Three spectrographic instruments were designed, fabricated and flown on rockets in order to add to our knowledge concerning the ultraviolet radiation from the sun. An echelle spectrograph was specifically designed to obtain high resolution ultraviolet spectrum. Instrumentation was designed to determine the composition of the upper atmosphere by absorption methods, this instrumentation will also be flown on a rocket at a later date, after adequate laboratory testing has been accomplished. Considerable research concerning phosphor efficiencies and optical properties of metals in the far ultraviolet has been accomplished to supplement the overall program of obtaining experimental data concerning solar radiation and atmospheric composition. Author (TAB)

N66-30747*# New Hampshire Univ., Durham. Dept. of Physics.

VIOLATION OF THE SECOND AND THIRD ADIABATIC INVARIANTS BY HYDROMAGNETIC WAVES

Barney Jay Conrath (Ph. D. Thesis) Oct. 1965 117 p refs (Grant NsG-624)

(NASA-CR-76294) CFSTI: HC $4.00/MF $0.75 CSCL 20H

Violation of the second invariant is investigated, using a simplified model of converging field lines. Expresssions for characteristic lifetimes and diffusions have been obtained and numerical examples are given. Violation of the third invariant by large scale magnetic disturbances with a sinusoidal dependence is investigated, using an image dipole model. Characteristic diffusion times are derived and the formulation is applied to an example of electrons with energies greater than 1.6 Mev at $L = 4$. The sinusoidal model is also compared with the sudden disturbance models of previous studies. The results of the studies are used to define measurements which could be employed to study the specific mechanisms experimentally. The calculations of this study are primarily intended to be used as tools in the correlation of particle data with magnetic field data. Author

N66-30846*# California Univ., La Jolla.

DISTORTION OF THE MAGNETOSPHERE DURING A MAGNETIC STORM ON 30 SEPTEMBER, 1961

L. J. Cahill, Jr. and D. H. Bailey (New Hampshire Univ.) Jun. 1966 37 p refs

(Contract NASw-155; Grants NsG-624; NsG-538)

(NASA-CR-76362; UCSD-SP-66-3) CFSTI: HC $2.00/MF $0.50 CSCL 04A

A sudden comencement magnetic storm started on 30 September, 1961. The Explorer 12 Satellite was in orbit, in the day side of the magnetosphere, during the storm. During the recovery phase of the storm the field magnitude at 4 earth radii, and at magnetic latitudes above 20°, was increased. A low latitude pass, late in the recovery phase, revealed a field depression at 4 Re near the equator. The field distortions observed are attributed to inflation of the magnetosphere by low energy charged particles on field lines from $L = 2$ to $L = 5$. Author

N66-30878# Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics Div.

COEFFICIENTS OF DIFFUSION IN THE OUTER RADIATION BELT

Carl-Gunne Falthammer Aug. 1965 13p refs Paper presented at the Advanced Study Inst., "Radiation Trapped in the Earth's Magnetic Field", Bergen, 16 Aug.–3 Sep. 1965
(Rept.-65-16) CFSTI: HC $1.00/MF $0.50

This paper presents general expressions for the diffusion coefficients due to electric and magnetic disturbances that can contribute to the transport of particles. The disturbances to be considered are either time dependent electric potential fields (associated with large-scale plasma motions and magnetic bays) or magnetic time variations and their associated electric induction fields. The diffusion coefficient is in general energy dependent and can have a spatial variation different from the r^{10} variation characterizing the special case. I.M.

N66-30885# Paris Observatory, Meudon (France).
COSMIC RAYS AND SYNCHROTRON RADIATION [RAYONS COSMIQUES ET RAYONNEMENT SYNCHROTRON]
J. Lequeux Paris, ESRO, Mar. 1966 55 p refs In FRENCH; ENGLISH summary Presented at ESRO/CERS Summer School, Alpbach, Austria, 26 Jul. 1965
(ESRO-SM-54) CFSTI: HC $3.00/MF $0.50

After recalling the chief properties of synchrotron radiation the author reviews all the discrete radio sources now known which all emit by synchrotron radiation and, hence, are also quite probably sources of cosmic rays. Acceleration, injection and propagation of cosmic radiation are dealt with. The two main acceleration processes are the betatron process and the Fermi process. Their effect, combined with the effects of losses and leaks, determines the energy spectra. Propagation is studied with the help of two models: lines of force and inhomogeneities. Losses occurring during propagation and fragmentation due to collision and creation of secondary electrons are discussed. Experimental results clearly show the preponderance of the light elements and yield quantitative information on the quantitative composition of the electronic radiation. The author concludes that in order to know the origin of cosmic ray electrons we ought to: (a) improve the galactic model, (b) measure the e^+e^- ratio, and (c) measure the electron spectrum in the 0.25 GeV range, so as to compare it to the spectrum radiation. Author

N66-31135# Air Force Cambridge Research Labs., Bedford, Mass. Space Physics Lab.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME II, NUMBER 2
Anne L. Carrigan and Norman J. Oliver, ed. [1965] 224 p
(AD-624195) CFSTI: HC $6.00/MF $1.25

Data for April, May, and June 1965 are presented in tabular and graph form. In addition to the regular reporting stations, São José dos Campos, Brazil, contributed for the first time. The areas of data recording are: total field intensity magnetometer; cosmic ray neutron intensity monitor; oblique backscatter radar; oblique hf propagation; riometer; solar optical patrol observations; solar radio emission; and vertical incidence ionospheric soundings. N.E.N.

N66-31167# Sydney Univ. (Australia). Falkiner Nuclear Dept.
NUCLEAR INTERACTIONS OF THE SECONDARY PARTICLES OF HIGH ENERGY COSMIC RAY JETS
Elizabeth Farrow, C. F. Gauld, C. B. A. Mc Cusker, J. Malos, K. Nishikawa et al [1962] 9 p refs
(Grants AF-AFOSR-61-92; AF-AFOSR-62-410)
(AFOSR-4790; AD-623498)

Fifty-five interactions in the energy range 1 to 100 GeV of secondary particles of cosmic-ray jets have been examined. The energy was determined by finding the angle between the secondary and primary direction and assuming a transverse momentum of 0.4 GeV/c. The interaction mean free path was 41.7 cm, the average number of shower particles varied from 1.3 to 6.4 and the average number of black prongs from 5.8 to 8.3 as the energy went from 2.8 to 34.6 GeV. The agreement with machine work is good, in contrast to previous experiments where the Castagnoli method of energy estimation and/or area scanning was used. The application of the method to energies around 1000 GeV is discussed.
Author (TAB)

N66-31189# Royal Inst. of Tech., Stockholm (Sweden). Electron and Plasma Physics Div.
ON THE RADIAL MOTION OF GEOMAGNETICALLY TRAPPED PARTICLES DUE TO PERTURBATIONS THAT CHANGE THE THIRD ADIABATIC INVARIANT
Carl-Gunne Faelthammar [1965] 14 p refs Presented at the 6th Intern. Space Sci. Symp., Mar Del Plata (Argentina), 13–19 May 1965
(Rept.-65-09) CFSTI: HC $1.00/MF $0.50

The effect of time-dependent large-scale electric potential fields on the motion of geomagnetically trapped particles is considered. Results are given of a detailed theoretical analysis of radial motion caused by random field variations, in the case where only the third adiabatic invariant is changed, as seems to be the case for protons in the outer magnetosphere. The corresponding effect of magnetic disturbances has already been analyzed in the literature although only for special models. A somewhat generalized analysis is given here. The importance of rocket and satellite observations of the electric field in the magnetosphere is emphasized. Author

N66-31202# Kodaikanal Observatory (India).
ACTIVE PROMINENCES AND ASSOCIATED TERRESTRIAL EFFECTS
J. V. Narayana 1965 11 p refs *Its* Bull. No. 165
CFSTI: HC $1.00/MF $0.50

All cases of prominences with high activity were collected from I.G.Y. Solar Activity Report Series in order to find out their possible association with terrestrial effects similar to those observed in the case of solar flares. Special care was taken in selection of cases of prominences so as to avoid the overlapping effects of any solar flares. The study revealed that about 90% of cases of active prominences were followed by bursts of solar radio-radiation, about 60% by partial or complete shortwave radio fadeouts and about 7 to 20% of other S.I.D's like S.E.A., SCNA etc. Thus it is seen that prominences of high activity are also sources of enhanced solar radio-radiation and X-rays, and are probably next in importance to that of solar flares. Some direct observational evidences and theoretical considerations are also given in support of the above conclusion. Author

N66-31245# Naval Ordnance Lab., Corona, Calif.
MILLIMETER RADIOMETRY AND ITS APPLICABILITY TO AN AIRBORNE THERMAL MAPPING SYSTEM
James W. Battles and Delbert E. Crane 15 Apr. 1966 45 p refs
(NOLC-646; AD-482042)

Problems relating to the use of a millimeter radiometer in the atmosphere are discussed and areas in which further research must be conducted are pointed out. A discussion of the expected performance of a 94 Gc radiometer constructed from commercial components is also included, along with a review of presently available millimeter components. Author

N66-31359*# General Electric Co., Philadelphia, Pa.
ATMOSPHERIC TRANSITION CURVES FOR GEOMAGNETICALLY-SENSITIVE COSMIC RAYS Final Report
Robert C. Good, Jr. Mar. 1966 45 p refs
(Contract NAS1-5254)
(NASA-CR-66110) CFSTI: HC $2.00/MF $0.50 CSCL 20H

An attempt is made to reduce some existing observational data on the nuclear cascade in the atmosphere to a form suitable for comparison with nuclear cascade calculations. This data reduction consists in removing from the observational data the contribution of primaries whose energies are too high to permit the cascades they indicate to be calculated with confidence. The procedure is similar to, though simpler than, that used in deriving specific yield functions for use in cosmic ray physics. The results are presented in a family of curves. There is an indication that the number of neutrons at any given depth in the atmosphere is not a sensitive function of the incident rigidity between ~10 and ~15 GV. Prescriptions for comparing calculations with these or similar curves are given. Appendix B contains some illustrative curves for incident α particles. Author

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N66-30016# Texas Univ., Austin. McDonald Observatory.
SPECTROSCOPIC AND RADIAL VELOCITY SURVEY OF BRIGHT GALAXIES. SOME OBSERVATIONS OF INSTABILITY PHENOMENA IN GALAXIES
G. de Vaucouleurs Apr. 1966 12 p refs
(Contract N00014-66-C0061)
(TR-1; AD-632021) CFSTI: HC $1.00/MF $0.50

Phenomena suggestive of large-scale instability in galaxies were observed during the past 15 years at the Mt. Stromlo and McDonald Observatories. A few typical examples are described, mainly from recent photometric and spectroscopic observations at McDonald Observatory. Author (TAB)

N66-30082*# National Aeronautics and Space Administration, Washington, D. C.
OBSERVATIONS OF THE MOON, MARS, URANUS, AND THE STARS. OPTICAL PROPERTIES OF PLANTS [NABLYUDENIYA LUNY, MARSA, URANA I ZVEZD. OPTICHESKIYE SVOYSTVA RASTENIY]
G. A. Tikhov, ed. Jun. 1966 320 p refs Transl. into ENGLISH of the publ. "Trudy Sektora Astrobotaniki", v. 8 Almaata, Izd. Akad. Nauk Kazakh. SSR, 1960
(NASA-TT-F-419) CFSTI: HC $6.00/MF $1.75 CSCL 03B

Optical properties of various species of plants are considered in a collection of papers dealing with observations of the Moon, the planets Mars and Uranus, and some variable stars. Martian observations are reported for the 1909 and 1958 oppositions; and a number of articles are devoted to spectral investigations of the Moon, Uranus, magnetic and variable stars, and the asteroids Vesta and Eunomia. Electrophotometric investigations of the Moon and Mars are also included, as are spectrophotometric studies of cultivated and wild plants. Various speculations are made as to the possibility of life on Mars, and twilight phenomena in the Earth's atmosphere are examined. M.W.R.

N66-30178*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPROXIMATION OF REENTRY ANGLES OF ATTACK FOR A SPINNING BODY FROM RATE-GYRO AND ACCELEROMETER DATA
Charles H. Whitlock Washington, NASA, Jul. 1966 42 p refs
(NASA-TN-D-3492) CFSTI: HC $2.00/MF $0.50 CSCL 22A

A technique for approximating reentry angles of attack from rate-gyro and accelerometer data is developed. The analysis is independent of initial conditions and mass and inertia terms, produces α and β as well as η histories, is independent of basic aerodynamic and trajectory parameters, and is workable around periods of lost data. The method is limited to spinning bodies having aerodynamic roll symmetry and assumes negligible-gravity, earth-rotation, and aerodynamic-damping-force effects. By use of an analytical simulation technique, the analysis is demonstrated with three typical reentry situations as examples. A portion of flight data is also analyzed, and the results are compared with those of another technique of analysis. Author

N66-30189# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).
DIFFERENTIAL CORRECTION PROGRAM FOR THE ORBITAL PARAMETERS OF A SATELLITE NEAR THE EARTH [PROGRAMME DE CORRECTION DIFFERENTIELLE DES PARAMETRES D'ORBITE D'UN SATELLITE PROCHE DE LA TERRE]
Nicole Morael-Courtois (Ph.D. Thesis—Paris Univ.) Mar. 1966 48 p refs In FRENCH
(CNES-NT-5) CFSTI: HC $2.00/MF $0.50

A computer program is presented for the numerical determination of an artificial satellite orbit from either radio or optical observations. The results are given from the calculation of the orbital parameters of satellite 6532 A as an example. Transl. by D.T.

N66-30248# System Development Corp., Santa Monica, Calif.
SMALL ECCENTRICITY AND THE RESTRICTED PROBLEM OF THREE BODIES
Richard B. Barrar 17 Mar. 1966 17 p refs
(SP-2394/000/00; AD-632474) CFSTI: HC $1.00/MF $0.50

The author's previous work on the convergence of the Poincare–Von Zeipel procedure is modified to apply to problems involving small eccentricity. The results are applied to the restricted problem of three bodies. Author (TAB)

N66-30277*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
CONCERNING A NEW THEORY OF TYPE I COMET TAILS
Norman F. Ness and Bertram D. Donn Jun. 1965 32 p refs Presented at the 13th Intern. Astrophys. Symp., 5–7 Jul. 1965
(NASA-TM-X-55287; X-612-65-272) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A theory is presented concerning the formation of Type I comet tails, based on the observation and measurement of the solar wind's continuous flux. The wind's interaction with the geomagnetic field leads to the development of an extended tail with an imbedded magnetically neutral sheet. This neutral region represents an effect of enhanced density plasma confinement, which may have a parallel in the rays of Type I comet tails. Because the solar wind is magnetized and convectively transports solar field lines into interplanetary space, it is not necessary that comets possess an inherent magnetic field

It is suggested that the observed reversals of direction in the interplanetary medium are reflected into the tails of comets by the formation of neutral tubes. These tubes form the trapping regions for plasmas which are observed visually. Time lapse photography of the dynamics of tail rays and investigations of perspective effects on tail structure are proposed as critical tests of this hypothesis. D.T.

N66-30282*# TRW Systems, Redondo Beach, Calif.

IONIZATION PROBABILITY OF IRON PARTICLES AT METEORITIC VELOCITIES

J. C. Slattery and J. F. Friichtenicht 18 Feb. 1966 25 p refs (Contract NASw-1336)

(NASA-CR-74110; TWR-4525-6001-R-0000) CFSTI: HC $1.00/MF $0.50 CSCL 03B

The number of ion pairs produced by the total ablation of iron particles in air and argon was measured as a function of particle velocity. Micron size iron particles of known mass and velocity were injected into a gas target chamber and the resultant ionization collected with a parallel plate ionization chamber. Initial velocities of the particles ranged from 20 km/sec to 45 km/sec. The ionization probability for an iron particle in argon was found to $=3.84\times10^{-21}v^{4.13}$, where v is the particle velocity in meters/sec. The ionization probability of an iron particle in air was found to $=3.63\times10^{-18}v^{3.12}$, with v in m/sec. Author

N66-30288# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THEORY OF MOTION OF ARTIFICIAL EARTH SATELLITES

Y. V. Batrakov *In its* Herald of the Acad. of Sci. of the USSR 4 Aug. 1965 p 8–10 (See N66-30286 17-34) CFSTI: HC $1.00/MF $0.50

Summarized conference reports on the general theory of the motion of artificial earth satellites are mentioned briefly. This listing includes: liberational motions of a satellite moving along an elliptical orbit; properties of perturbed motion of an artificial satellite near the center of masses; translational–rotational motion of simple bodies under earth attraction; perturbed motion of satellite in gravitational field and earth atmosphere; secular and long-period perturbations of a satellite of a nonspherical planet; generalized problems of two motionless attracting centers; application of the Delaunay method to the investigation of the motion of artificial satellites of the moon; use of averaged schemes for the calculation of perturbations; and, perturbation of the major semi-axis under the action of resistance of a nonspherical atmosphere. More emphasis was on: observations and calculation of the ephemerides of satellites; the figure and gravitational field of the earth; and, motion of space rockets (lunar and interplanetary). R.LI.

N66-30296*# Sperry Gyroscope Co., Great Neck, N. Y. Sperry Rand Systems Group.

SPACE STATION STABILIZATION AND CONTROL STUDY

Final Engineering Report

I. N. Hutchinson, R. Steuer, R. Morrison, and K. Thomson Dec. 1963 195 p refs

(Contract NAS1-2946)

(NASA-CR-66019; AB-1210-0020) CFSTI: HC $5.00/MF $1.25 CSCL 22A

A feasibility study on stabilizing and controlling a flexibly coupled, spinning, manned space station was conducted to provide a means of obtaining an artificial gravity station environment within near-term booster payload limitations. It was concluded that: (1) The dynamics of flexibly coupled vehicles are relatively insensitive to cable configuration. (2) Extension and retraction of the cabled vehicle can be readily performed, and only slightly more (6 percent) propellant is required to spin the flexible vehicle than would be required to spin a rigid vehicle. (3) The stabilization and control functions can be provided with state-of-the-art components of reasonable size, weight, and power. (4) The only unique component required in the control system is a large two-degree-of-freedom control moment gyro. Specific items for follow-on effort are listed, including those for model generation, configuration and control system. Additional data are presented on actuator comparisons for roll-pitch damping; equations for extension–retraction model; generalized cable influence; and, propellant requirements. R.LI.

N66-30315*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.

A SPECIAL-PURPOSE INTERPLANETARY TRAJECTORY COMPUTATION PROGRAM FOR GUIDANCE AND NAVIGATION STUDIES

William T. Mc Donald Jul. 1965 77 p refs

(Grant NsG-254-62)

(NASA-CR-76127; RE-19) CFSTI: HC $3.00/MF $0.75 CSCL 22C

An interplanetary trajectory computation program, written specifically for use in making comparative evaluations of interplanetary guidance and navigation techniques, is described. Special requirements and the corresponding capabilities of the program are explained, including: simultaneous state and state transition matrix integration; a fixed time of arrival and fixed target point trajectory search capability; computation of trajectories in either time direction; ease of program modification by non-professional programmers; and ability to batch-process at a high speed, high volume computation center. Computational error sources are discussed and typical accuracy data are given. The program subroutine structure and functional flow are described briefly. Data are presented to illustrate operation of the single-precision version of the program. A double-precision version is also available. Both versions are available in Fortran II and Fortran IV languages. Author

N66-30332*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

LONG PERIOD LUNAR AND SOLAR EFFECTS ON THE MOTION OF RELAY 2

Theodore L. Felsentreger Mar. 1966 46 p refs

(NASA-TM-X-55509; X-547-66-102) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Long period perturbations in the orbital elements of Relay 2, arising from luni-solar gravitation and solar radiation pressure, are analyzed. An analysis is presented of the effects on the eccentricity and inclination caused by the existence of a near-resonant condition in two of the trigonometric terms in the luni-solar disturbing function. Author

N66-30344*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

DYNAMICAL BEHAVIOR OF EJECTA FROM THE MOON: PART I: INITIAL CONDITIONS

Barbara E. Shute Apr. 1966 83 p refs

(NASA-TM-X-55521; X-643-66-158) CFSTI: HC $3.00/MF $0.75 CSCL 03B

A reduced form of the patch conic method has been employed to determine the initial orbital elements of a particle launched or ejected from the moon's surface with any arbitrary starting conditions. The reduction was obtained by considering the selenocentric velocity asymptotes. Explicit and tractable analytic functions have been derived for the geocentric and Jacobi energies, angular momentum, standard orbital elements, and conditions for moon-to-earth trajectories. Percents of randomly ejected material which initially strike earth, are in retrograde orbits, or go into heliocentric orbits have been obtained. The results are compared with results obtained by a numerical integration program for several different situations.
Author

N66-30349*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ULTRAVIOLET REFLECTIVITY OF VENUS AND JUPITER

Dennis C. Evans May 1966 32 p refs

(NASA-TM-X-55526; X-613-66-172) CFSTI: HC $2.00/MF $0.50 CSCL 03B

Low resolution, ultraviolet spectrograms of Venus and Jupiter were obtained using objective grating spectrographs aboard an Aerobee rocket. One spectrograph was aimed at each planet, and the spectrograms obtained covered a wavelength range of 2300 Å to 3700 Å. The spectral resolution was determined by measurement of the width and depth of the solar spectral features at 2800 Å. It is noted that except for solar Fraunhofer structure, there are no narrow absorption features (50 Å to 100 Å) in the Venus spectrum; an absorption feature at 2600 Å was noticeable in the Jupiter spectrum. The spectra of the planets are interpreted and presented in terms of geometric reflectivity. Reflectivity is discussed in relation to cloud surface absorption and atmospheric scattering, with no absorption in the atmosphere; and by atmospheric scattering, ozone absorption, and reflection from the cloud surface. Tables list the reflectivity of a planet with a Rayleigh scattering atmosphere at 90° phase angle, and the albedo parameters of Venus and model planets; figures depict the spectra and geometric reflectivities of Jupiter and Venus.
M.G.J.

N66-30353*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

COMPUTATION OF THE LONG RANGE MOTION OF A LUNAR SATELLITE

Isabella J. Cole May 1966 42 p refs

(NASA-TM-X-55530; X-547-66-196) CFSTI: HC $2.00/MF $0.50 CSCL 03C

Formulae for long periodic perturbations depending on the argument of the pericenter are derived by the method of harmonic analysis and with elliptic integrals. An approximation of the terms of the energy integral that are dependent on the oblateness was used in the solution with elliptic integrals.
Author

N66-30355*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

A COMPARISON BETWEEN INTENSITIES OF A GEOS-A FLASH SEQUENCE AS RECORDED BY PHOTOGRAPHIC AND ELECTRO-OPTICAL TECHNIQUES

S. H. Genatt May 1966 20 p refs

(NASA-TM-X-55532; X-524-66-201) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A sequence of seven flashes of the GEOS-A satellite was recorded simultaneously by a PC-1000 camera and an electro-optical set up located nearby. Calculations show that the seventh flash should be approximately 6% fainter in brightness than the first flash. Densitometer measurements of the flash images were compared with oscilloscope traces of the same event. The electro-optical recordings appear to represent the calculated individual brightnesses slightly better than the photographic plate.
Author

N66-30357*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

USE OF MEAN ELEMENTS TO CALCULATE THE POSITION OF THE SUN, MOON AND EARTH

R. J. Sandifer Jan. 1966 45 p refs

(NASA-TM-X-55534; X-507-66-209) CFSTI: HC $2.00/MF $0.50 CSCL 03C

Formulae for the calculation of the mean orbital elements of the Earth, Moon, and Sun are presented in tabular form for the Julian Date equivalent to the calendar date, 12 hours ephemeris time, January 0, 1900. The elements are listed in six combinations of units: three angular units of degrees, radians and revolutions and two time units of days and Julian centuries. A method is described for updating the numerical coefficients to any arbitrary epoch in order to eliminate double precision arithmetic in computer usage of these expressions. An algorithm is presented for the calculation of the selenocentric position vectors of the Earth and Sun neglecting periodic perturbations.
Author

N66-30360*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE LIBRATION OF A LUNAR SATELLITE

David Fisher and Theodore L. Felsentreger May 1966 28 p refs

(NASA-TM-X-55537; X-547-66-238) CFSTI: HC $2.00/MF $0.50 CSCL 03C

It is shown that the long range variations of the orbital elements of a lunar satellite in libration is periodic, but non-analytic, in nature. A method for finding the period of the motion, as well as the variations of the elements with time, is described.
Author

N66-30366*# National Aeronautics and Space Administration, Washington, D. C.

PROCEEDINGS OF THE FIFTH NATIONAL CONFERENCE ON THE PEACEFUL USES OF SPACE

1966 212 p refs Conf. held in St. Louis, 26-28 May 1965 (NASA-SP-82) GPO: HC $1.50; CFSTI: MF $1.25 CSCL 22A

Conference papers on the impact of past and future space exploration on industry, communications, science, and education are presented. For individual titles see N66-30367-N66-30391.

N66-30367*# National Aeronautics and Space Administration, Washington, D. C.

LOOKING TOWARD MATURITY IN THE SPACE AGE

Hugh L. Dryden *In its* Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 5-10 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The framework is set for a conference on the peaceful uses of space by examining the rapid growth in space activities and their relation to and interaction with science and technology in general. The achievement of maturity in space research and development is emphasized, and cooperative efforts among government, industry, and universities is stressed. It is pointed out that the subject of broad national goals for the space program has emerged as a subject of public debate during the past two years; and with this in mind, the national

goals are restated in the following manner: (1) to obtain maximum benefit to the welfare of the nation and to all mankind and (2) to provide both material benefits to free men in a peaceful world and incentives for mental and spiritual growth and accomplishment. M.W.R.

N66-30368*# National Aeronautics and Space Administration, Washington, D. C.
MANNED SPACE FLIGHT: PROGRAMS, PROGRESS, PROSPECTS
George E. Mueller *In its* Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 11–14 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

An overview is presented of the NASA manned space flight programs and launch vehicles and spacecraft developed for the Apollo project. A few examples are given to illustrate the broad spectrum of manned missions made possible by the Apollo development, such as: (1) low- or high-inclination, polar or synchronous orbits for research in near-earth space; (2) low-inclination orbit below the Van Allen belts to study rendezvous and resupply problems in space; and (3) polar orbit to survey the world's resources. Possibilities for the use of the Lunar Excursion Module of the Apollo spacecraft in long-term manned missions are also discussed. M.W.R.

N66-30369*# National Aeronautics and Space Administration, Washington, D. C.
THE SCIENTIFIC EXPLORATION OF SPACE: A PROGRESS REPORT
John F. Clark *In its* Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 15–21 (See N66-30366 17-30) GPO: HC $1.50 CFSTI: HC $1.25

Various aspects of the overall space science program are discussed, and a general review of programs and findings is presented. Scientific disciplines considered are astronomy, meteorology, geodesy, and bioscience; and data are included on energetic particles and magnetic fields as well as space communications. Applications of space research to the sun, atmosphere, ionosphere, moon, and planets are discussed. M.W.R.

N66-30370*# National Aeronautics and Space Council, Washington, D. C.
THE SPACE CHALLENGE
Edward C. Welsh *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 27–30 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The dynamic force behind the space effort, benefits inherent in the space program, energy sources for space missions, and space competition with the Soviet Union are discussed in terms of the challenge presented by and the future of the national space program. In comparing the United States and U.S.S.R. space programs, it is noted that while the Soviet Union is ahead in terms of payload weights, propulsion, and number of hours in manned flight; the United States is well ahead in applications for peaceful purposes such as weather observations, navigation, and communications. The United States is considered to have a possible advantage in relation to knowledge about space phenomena and the lunar surface, while the U.S.S.R. is said to have the advantage regarding the effects of space environments on human beings. M.W.R.

N66-30371*# Leiden Univ. (Netherlands).
THE FUTURE OF SPACE RESEARCH
Hendrik C. van de Hulst *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 34–39 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

It is emphasized that although space science is a new discipline with new problems and new possibilities, it must be considered as part of the larger field of science and find its answers through interdisciplinary efforts and observations. The solar system and its components, as well as the galaxy and universe, are discussed in terms of the future of space research programs. Attention is given to the study of comet tails, interstellar matter, and white light; as well as to astronomical resolution, calibration methods, and accessibility for space missions. M.W.R.

N66-30373*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.
SCIENTIFIC EXPLORATION OF THE MOON AND PLANETS
Gordon J. F. Mac Donald *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 54–62 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The dynamical development of the solar system, rotation of the planets, and planetary interiors and magnetic fields are discussed in relation to scientific exploration of the moon and planets. A brief survey of recent developments is given and specific problems relating to such explorations are considered. In addition to investigating the dynamics of the solar system, attention is given to the dynamics of the planets and of the satellites as they move about their primaries. Orbital elements of the planets are tabulated, the earth-moon tidal friction interaction is illustrated, and past variation in earth-moon distance is graphed. Angular-moment density associated with the rotation of the planets is plotted and the variation of temperature is shown for a moon having chondritic radioactivity uniformly distributed. M.W.R.

N66-30374*# Cornell Univ., Ithaca, N. Y. Center of Radiophysics and Space Research.
THE PURPOSE OF SPACE RESEARCH
Thomas Gold *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 63–68 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

It is speculated that the day will come when the average man will be educated to understand the theory behind the technology of space research, and that scientists have a responsibility to advance and simplify the necessary educational procedures. In this way scientists can implement the principal purposes of space research, which are stated as follows: (1) to marshal human interest in science; (2) to introduce great communal efforts, for intellectual purposes; (3) to use the spirit of adventure and exploration for noble ends and, thereby, channel space research into peaceful and constructive uses. Observations made by the IMP satellites and photographs by Ranger are cited. M.W.R.

N66-30379*# National Aeronautics and Space Administration, Washington, D. C.
TODAY'S RESEARCH SETS TOMORROW'S CAPABILITIES IN SPACE
Raymond L. Bisplinghoff *In its* Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 101–109 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF 1.25

Attention is given to the technical imponderables inherent in the exploration of space; and the technological innovations needed to achieve orbiting laboratories, manned

flights to the moon and near planets, and probes of the sun and deep space are considered. Principal areas for investigation are listed as the development of very light structures; efficient conversion of solar, chemical, and nuclear energy for propulsion and electric power generation; accurate guidance, controls, and communications; and reliable operation for long periods of time in the space environment. Improvement in temperature capabilities of various materials is discussed, as are heat transfer of reentry bodies, range capability in relation to hypersonic lift–drag ratio, hydrogen–fluorine rocket engine tests, and solid core reactors and advanced propulsion. Also discussed are the accuracy required for calibration and sensing, laser tracking, and the role of the human and the equipment necessary to sustain him in space. M.W.R.

N66-30380*# General Electric Co., New York. Aerospace and Defense Group.

SCIENCE IN AND FOR SPACE EXPLORATION

Richard W. Porter *In* NASA. Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 110–114 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

Demands on science by space technology are discussed; and examples are given of rockets, satellites, and various instruments that have been designed to meet technological needs related to space exploration. It is stressed that science is really the utilization of instruments and conveyances to extend the range of existing knowledge; and that the problems of building those instruments and conveyances frequently provide the incentive for scientific work which otherwise might not receive prompt attention. While individual basic researches may not led to major scientific discoveries, they do represent a quest for knowledge and the truth. M.W.R.

N66-30387*# National Aeronautics and Space Administration, Marshall Space Flight Center, Huntsville, Ala.

CHALLENGE OF THE CENTURY

Wernher von Braun *In* NASA. Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 165–169 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

Space projects of the future will be based on the extension of today's technology and thus on the availability and capability of operational launch vehicles. New developments in recovery and reuse of the first stage of the Saturn V, improvements in the Saturn V propulsion systems, and possible new engines for the upper Saturn stages can lead to an increased payload capability of more than 50 percent. Reusable space vehicles are a basic necessity to make Earth-to-orbit trips or Moon flights commercially feasible, and to extend man's exploration of the solar system. G.G.

N66-30388*# Atomic Energy Commission, Washington, D. C.

SPACE EXPLORATION AND ITS ATOMIC ENERGY IMPLICATIONS

Gerald F. Tape *In* NASA. Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 173–184 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The utilization of fission and isotopic fuels for advanced space missions in future years is discussed. First generation SNAP-10A system tests demonstrated 600 watts initially with no control after startup, and 535 watts at the end of 43 days; these flight tests proved that it is possible and practical to operate a space reactor power plant in orbit. Isotopic space power systems with their reliable operation of long lived thermoelectric generators offer the greatest advantages for continuously operating Earth orbiting communication, navigation, and meteorological satellites. Nuclear rocket propulsion tests utilizing graphite reactor systems also performed successfully; however, temperature limitations in solid core reactors as imposed by the structural integrity of the solid materials led to considerations of advnaced nuclear propulsion concepts. Theoretical possibilities of liquid and gaseous reactors and pulse systems showed specific impulse potentials in the range of 1200 to 4000 seconds. It is noted that the two most promising applications for nuclear rocket propulsion systems are for manned planetary exploration and direct flights of manned spacecrafts to the moon. G.G.

N66-30389*# Lockheed Missiles and Space Co., Sunnyvale, Calif.

OPPORTUNITIES IN SPACE EXPLORATION IN THE FUTURE—AN IMAGINATIVE PROJECTION

L. Eugene Root *In* NASA. Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 185–189 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

Projected is life in a small city on an orbiting space station a few hundred miles from Earth. An average population of 4000 people is assumed, mostly working in research laboratories, universities, and the hotel enterprise. The city's utility complex consistes of a combination solar and nuclear power system with a standby battery supply to maintain life support and communications in the entire city for the period of one week. Atmosphere and water systems provide solid waste disposal as well as regeneration of both oxygen and water. The communication network includes a direct link to master communications satellites for all voice and video circuits. A space linear transportation center handles the Earth-to-space station traffic, as well as the lease and sale of small electric vehicles to be used for local traffic. G.G.

N66-30394*# Grumman Aircraft Engineering Corp., Bethpage, N. Y.

POLARIMETRIC MEASUREMENTS OF SIMULATED LUNAR SURFACES Final Report

W. G. Egan, L. L. Smith, and G. C. McCoyd May 1966 264 p refs

(Contract NAS9-4942)

(NASA-CR-76169; RE-250) CFSTI: HC $8.00/MF $1.50 CSCL 03B

An experimental study and a theoretical study consisted of: (1) polarimetric investigation in visual light (0.54μ) of natural specimens having a good photometric match to the moon; (2) polarimetric investigation in visual light of pulverized specimens to determine particle size effects; (3) polarimetric investigation of contrived models combining the above results in blue (0.45μ), green (0.54μ) and infrared (1.0μ) wavelengths; and (4) theoretical analysis of lunar and laboratory data. The overall conclusion is that the polarization properties of the lunar surface can be produced by a suitable material with a particulate coating of itself. Thus, the surface properties could yield information on the underlying matter and ultimately give information as to the choice of good landing areas for the Apollo mission. The existence of a correlation betwen albedo and polarization on a theoretical basis was confirmed. Author

N66-30437# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).

EVOLUTION OF AN HOMOGENEOUS SPHERICAL GAS [EVOLUCION DE UN GAS ESFERICO HOMOGENEO]

F. Cernuschi and F. R. Mariscano (Buenos Aires Univ.) 1965 23 p refs Presented at the COSPAR Meeting, Mar Del Plata, Argentina, May 1965

(CNIE-PT-4) CFSTI: HC $1.00/MF $0.50

Some possible processes of expansion of a gaseous stellar mass are studied. It is assumed: (a) that the spherical form and a uniform distribution of the mass are maintained; (b) the perfect gas law is applicable; (c) that the total mass is kept constant; (d) that the evolution is adiabatic. By applying the virial theorem, a differential equation is obtained which permits the analysis of different types of expansion processes. The conditions for limited expansions, of the considered spherical gaseous mass, are deduced for the cases when (a) the radiation pressure is negligible; (b) the corpuscular pressure is negligible in front of the radiation pressure; (c) both pressures are taken into account. The case when there exists a uniform magnetic field proportional to the square root of the density is also studied. Author

N66-30486*# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.

SPECIAL-PURPOSE INTERPLANETARY TRAJECTORY COMPUTATION PROGRAM FOR GUIDANCE AND NAVIGATION STUDIES—USER'S MANUAL

William T. Mc Donald Jul. 1965 40 p refs

(Grant NsG-254-62)

(NASA-CR-76160) CFSTI: HC $2.00/MF $0.50 CSCL 22C

This manual provides the necessary information for use and modification of the interplanetary trajectory computation program. It has been prepared as a supplement to Ref. (1), which gives a technical description of the program. This manual describes input and output data formats and contains detailed functional flow charts for the program. An example of a typical trajectory computation is given also. Author

N66-30535*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

PRELIMINARY INVESTIGATIONS OF SPACE MAINTENANCE

Jerome S. Seeman, Francis H. Smith, and Donald D. Mueller (Air Force Academy) 15 Jun. 1966 35 p refs Presented at Symp. on Spacesuits and Human Performance at Am. Psychological Assoc. Ann. Conv., Los Angeles, Sep. 1964; Sponsored by Soc. of Eng. Psychologists

(NASA-TM-X-53246) CFSTI: HC $2.00/MF $0.50 CSCL 22A

This report recounts experiments in simulation of a basic, space-maintenance task under earth-gravity and zero-gravity conditions. Experiments were performed with human subjects in space suits under shirtsleeve, shirtsleeve-equivalent, vented, and full-pressure conditions. The task was removal and replacement of a prestart solenoid valve on an RL-10 rocket engine. It was necessary to enlarge the tool handles for operations with pressurized gloves. In the zero-g situation a body-tethering system was used; tool-loss was no problem. Subjects followed a prescribed sequence of operations in their performances. Supplemental experimenting was done with the Purdue Pegboard. Results of this work indicate no need to simulate zero-gravity in such studies. The key cause of performance-decrement is the pressurization level of the spacesuit. The synthesized results form a method for comparing performances of psychomotor tasks. Author

N66-30540*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

APPLICATION OF DOUBLE-AVERAGED EQUATIONS OF SATELLITE MOTION TO A LUNAR ORBITER

J. Lorell 30 Jun. 1966 20 p refs

(Contract NAS7-100)

(NASA-CR-76200; JPL-TM-33-287) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Equations of motion for artificial satellites of the moon disturbed by both third-body and oblateness effects are presented in their averaged and double-averaged forms. Efforts are focused on the applicability and the derivation of the double-averaged equations directly from the complete equations of motion. Implications for satellite lifetimes are interpreted in terms of specific orbits. The complete equations of motion are integrated, showing both short- and long-term effects; and, in addition, the effects of the sun and earth are compared. The conditions for instability caused by third-body perturbations of artificial satellites are listed. S.P.

N66-30600*# General Dynamics/Convair, San Diego, Calif.

POSTFLIGHT TRAJECTORY REASSEMBLY AC-6

L. G. Wilson and Brian R. Hurlbut 18 Feb. 1966 172 p refs

(Contract NAS3-3232)

(NASA-CR-76201; GD/C-BTD-66-012) CFSTI: HC $5.00/MF $1.00 CSCL 22C

The results of a trajectory reassembly analysis of Atlas/Centaur flight AC-6 are presented. The reassembly covers the flight portion from liftoff through Centaur retromaneuver and is based on perturbing vehicle systems parameters in a detailed trajectory simulation to effect a close match of flight measured position and velocity data throughout the simulation. The analysis stresses those systems having the greatest effect on trajectory design and payload capability. The Atlas stage trajectory was higher and faster than predicted and was due primarily to higher than nominal booster and sustainer thrust, and lower than predicted booster phase drag. Surveyor mission payload capability was 20 lbs greater than predicted. Centaur stage performance was less than nominal. The Centaur main engine thrust was 499 lbs low and specific impulse was 1.3 sec low. Vehicle system parameters determined from the AC-6 reassembly are tabulated. Vehicle system parameters used in the preflight simulation and engine values are shown for comparison. Spacecraft and Centaur tank orbit data are tabulated. R.N.A.

N66-30602*# Grumman Aircraft Engineering Corp., Bethpage, N. Y. Research Dept.

POLARIMETRIC MEASUREMENTS OF SIMULATED LUNAR SURFACES

W. G. Egan and L. L. Smith Apr. 1966 14 p Presented at the 121st Meeting of the Am. Astron. Soc., NASA, Langley Res. Center, Hampton, Va., 28–31 Mar. 1966

(Contract NAS9-4942)

(NASA-CR-76230; RM-323J) CFSTI: HC $1.00/MF $0.50 CSCL 03B

In an effort to lay the basis for an analytical approach, the polarization properties of volcanic ash and furnace slag were investigated as a function of particle size, albedo, and porosity. These investigations were made on a large scale polarimeter so that coarse specimens could be analyzed. For both samples, the maximum percent polarization (positive) and the corresponding phase angle at zero and 60° viewing angles, the inversion angle, and the minimum percent polarization (negative) varied as a function of porosity and albedo. The best fit to Crisium was achieved with Haleakala volcanic ash with particle sizes between 37 and 88 microns, and furnace slag less than 37 microns; Clavius was fitted with the ash of sizes less than 37 microns, and the furnace slag less than 1 micron.

The polarimetric properties of the furnace slag, volcanic ash, and additional laboratory samples were investigated for wavelength dependence. The best color-polarimetric and best visual photometric match to Crisium were obtained with coarse chunks of the volcanic ash topped with less than 1 micron particles of itself. Author

N66-30608*# Brandeis Univ., Waltham, Mass. Dept. of Physics

FOKKER–PLANCK TREATMENT OF THE EVOLUTION OF THE GLOBULAR CLUSTER IN ENERGY AND ANGULAR MOMENTUM SPACE

Paul Donald Easton (Ph.D. Thesis) Nov. 1965 100 p refs (Grant NsG-540; Contract AF 19(628)-4019)
(NASA-CR-76238) CFSTI: HC $3.00/MF $0.75 CSCL 03B

A simplified derivation of the Fokker–Planck velocity coefficients in the homogeneous case is presented. This involves a perturbation treatment of the stellar interactions, keeping only lowest order terms in the gravitational coupling constant. The method is extended to the derivation of the Fokker–Planck coefficients in energy and angular momentum for the inhomogenous case. It is shown that for a typical cluster it is reasonable to consider only interactions with field stars which pass through a region about the test star within which the stellar distribution is approximately homogeneous. Thus the determination of the Fokker–Planck coefficients reduces to integration over a test star orbit of the local Fokker–Planck coefficients for homogeneous field star distributions. This approximation makes a numerical calculation practical. Author

N66-30622# Joint Publications Research Service, Washington, D. C.

MASTERING OF THE MOON BY MAN

Yu. A. Gagarin and V. I. Lebedev 6 Jul. 1966 14 p refs Transl. into ENGLISH from Vopr. Filosofii (Moscow), no. 3, 1966 p 25–30
(JPRS-36326; TT-66-32758) CFSTI: $1.00

Problems inherent in space and lunar explorations are discussed in very general terms in a narrative which stresses the role of man in such endeavors. Assumptions regarding the lunar surface are made, lack of magnetic field on the moon is mentioned, and problems due to weightlessness are reported. M.W.R.

N66-30636# Naval Postgraduate School, Monterey, Calif.

OBLATENESS-PERTURBED ORBITS BY VELOCITY-CORRESPONDENCE VARIATIONS

Willard E. Bleick 20 Apr. 1966 22 p refs
(RP-65; AD-633239) CFSTI: HC $2.00/MF $0.50

This paper presents an elementary treatment of the first order differential effects of the earth's oblateness on a close satellite using the simple notion of a varied orbit. The usual result of this approach is that the radial variation is unbounded for infinite time. The standard method of celestial mechanics for removing this difficulty is to analyze the perturbed orbit as an ellipse whose shape and space orientation are functions of time. It is shown here that the secular term may be avoided more simply by relating points on the varied and unvaried orbits by a type of radial velocity correspondence instead of the usual time correspondence, and by making the varied orbit osculate at a latus rectum chord end point of the unvaried orbit. Author (TAB)

N66-30659*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.

LUNAR OCCULTATION AND PROVISIONAL IDENTIFICATION OF MSH 19-27

Larry W. Brown Mar. 1966 14 p refs
(NASA-TM-X-55498; X-615-66-123) CFSTI: HC $1.00/MF $0.50 CSCL 03B

A lunar occultation of the radio source MSH 19-27 was observed on June 16, 1965 with a parabolic antenna 85 ft in diameter which tracked the moon's center for the duration of the occultation. The receiver was a switched type system using gain modulation and had a frequency of 137 Mc/sec with an intermediate frequency of 30 Mc/sec, bandwidth of 2.5 Mc/sec, and RC integration time of 3 sec. Digitized records of the disappearance and reappearance of the source are shown. The records were analyzed with a computer program which convolved the digitized data with various restoring functions to produce the brightness distribution as it would be observed with a gaussian fan beam scanned along the position angle of the occultation. Examples of the restored data are presented. The data were restored with seven different beamwidths and a gaussian curve fitted to the resulting brightness distribution. Analysis of the fit provides the best values for the position of the intensity peak and the diameter of the source along the scan. Diameters and corresponding position angles are given. The radio source position was located on red and blue survey plates which are discussed and shown. R.N.A.

N66-30872# Leiden Univ. (Netherlands).

INTRODUCTION TO ASTROPHYSICS

H. C. Van de Hulst Paris, ESRO, Feb. 1966 24 p refs Presented at ESRO Summer School, Alpbach, Austria, 20 Jul. 1965
(ESRO-SM-51) CFSTI: HC $1.00/MF $0.50

A general review is given on astronomy, some of its historical developments and present problems. In the second chapter the stars, their classification and evolution are considered. The third chapter is devoted to interstellar matter. The last two chapters deal essentially with radioastronomical investigations and their results. Author

N66-30877# Brussels Univ. (Belgium). Inst. of Applied Mechanics.

STUDY OF THE VISIBILITY OF A SATELLITE, PART I [ETUDE DE VISIBILITE D'UN SATELLITE, PREMIERE PARTIE]

A. Jaumotte, J. Pennewaert and G. Kober 1964 27 p In FRENCH; ENGLISH summary Prepared for ESRO
CFSTI: HC $2.00/MF $0.50

The aim of this paper is to relate the observation parameters from one station (azimuth, elevation) to the satellite position on its orbit and then to deduce for each orbit the length of time during which observation is possible. The author then calculates the minimum time required for recording on the ground the data collected by the satellite ESRO I during one orbital period. He also studies the coverage of a network of stations for ESRO I (Waterloo, Spitsbergen, Kiruna, Anchorage, Falkland) and mentions the possibility of having it completed by the stations of the American STADAN network or that of CNES. I.M.

N66-31172# Library of Congress, Washington, D. C. Aerospace Technology Div.

GASEOUS NEBULAE AND GALAXIES Surveys of Soviet-Bloc Scientific and Technical Literature

E. Gelins 5 Aug. 1964 246 p refs Comprehensive Rept. (ATD-U-64-87; AD-622244) CFSTI: HC $6.00/MF $1.25

The report is divided into four parts. In Part I the following subjects are considered: the chemical composition of gaseous nebulae and dark clouds in interstellar space; dusty clouds and their absorption ability; the dynamical physical properties and processes in nebulae, as investigated by spectroscopic and photometric methods; distances to the gaseous nebulae; gaseous nebulae of the type known cometary nebulae; and the artificial sodium cloud. Part II is concerned with studies of various kinds of hot stars. The areas covered include: configuration equilibrium; studies of stellar atmospheres; physical properties of stars, including spectral analysis and polafization; novae and the causes of their formation; and young supergiant stars and the physical processes within these stars. Part III is devoted to galaxies. Interstellar matter, including the gas motion in the Galaxy and the magnetic field and the structure and dynamics of galaxies and the Metagalaxy clusters are considered. Part IV contains reviews of Soviet works on gaseous nebulae, hot stars, and galaxies. The books reviewed are used as textbooks for advanced students and specialists. TAB

N66-31177# Chalmers Univ. of Technology, Goteborg (Sweden).

SCINTILLATION OF DISCRETE RADIO SOURCES Report No. 62

Torleiv AA. Orhaug 1965 116 p refs *Its* Trans. No. 299 (AFCRL-65-509; AD-623753)

This paper deals with the theory of scintillation of discrete radio sources and results of scintillation observations made simultaneously at two frequencies. The discrete radio source Cygnus A was chosen for this study because its angle of elevation. Author (TAB)

N66-31186# European Space Technology Center, Noordwijk (Netherlands).

ATTITUDE PERTURBATIONS AND MAGNETIC CONTROL OF A SPIN-STABILIZED SATELLITE, PART I

Marc L. Renard Paris, ESRO, 17 Jan. 1966 167 p refs (ESRO-TR-1) CFSTI: HC $5.00/MF $1.00

The orientation at injection, and initial solar aspect angle, of a spin-stabilized satellite are computed. The attitude disturbing torques are then investigated systematically. For the residual-moment and gravity-gradient torques, Patapoff's results are used in inertial space. By an extension of the averaging procedure, formulae are derived for the torques due to eddy-current despin and precession, aerodynamic drag, and radiation pressure. A general approach is made to the problem of attitude control, through the use of d.c. pulses in a magnetic-coil axis perpendicular to the spin axis. When particularized to orbits of small eccentricity, the results enable one to assess, analytically or through practical physical models, different possible 'types' of pulses, as related to spin-axis orientation and orbital geometry. As an illustration, control 'in a point' and 'in a plane' are compared if it is wanted to keep the solar angle 90°. Preferential directions are found which minimize the 'solar angle drift'. Finally, magnetic respin, and its effect on attitude, are examined. Author

N66-31187# University Coll., London (England).

AN ANALYSIS OF MARTIAN CLOUDS AND THEIR TOPOGRAPHICAL RELATIONSHIPS

R. A. Wells Paris, ESRO, May 1966 63 p refs (ESRO-SN-54) CFSTI: HC $3.00/MF $0.75

The frequency of cloud occurrences distributed against heliocentric longitude is displayed in histogram form for the two chief cloud groups, white and yellow. White clouds show two peaks of maximum occurrence, while yellow clouds appear to show three peaks. Aerographic latitude plots of white and yellow cloud positions against heliocentric longitude reveal that the darkening wave is due to the transport of both water vapor and dust from high latitudes towards the equator. An examination of certain white clouds implies that at least some of the dark maria are elevations. Order of magnitude estimates of these mountain heights are calculated by a new method. The unusual 'W'-shaped cloud phenomena are explained by orographically-produced air disturbances which imply that mountain ridges may be present on the surface with their axes arranged in the general patterns of a 'W'. Author

N66-31227*# National Aeronautics and Space Administration, Washington, D. C.

CERTAIN RESULTS OF OBSERVATIONS TAKEN DURING THE SPACE FLIGHT OF THE VOSKHOD [QUELQUES RESULTATS D'OBSERVATIONS EFFECTUEES AU COURS DU VOL COSMIQUE DU VOSKHOD]

K. Feoktistov, G. Rozenberg, A. Sandomirskiy, V. Sergeyevich, and D. Sonechkin Aug. 1965 20 p Trans. into ENGLISH of a paper presented at the 8th Plenary Meeting and 6th Intern. Space Sci. Symp. COSPAR, Buenos Aires, 10–21 May 1965

(NASA-TT-F-9551) CFSTI: HC $1.00/MF $0.50 CSCL 22A

Observations performed by the crew of the Voskhod completed experiments begun on the Vostoks. Preliminary results, both photographic and visual, are discussed. Author

N66-31258# Chicago Univ., Ill. Dept. of Astronomy.

INVESTIGATIONS OF THEORETICAL PROBLEMS IN COSMICAL GAS DYNAMICS Final Report, Jan. 1–Dec. 31, 1965

Peter O. Vandervoort 18 Apr. 1966 11 p refs (Grant Nonr-(G)-0009-65)

(AD-632705) CFSTI: HC $1.00/MF $0.50

Various aspects of the evolution of H II regions (gaseous nebulae) surrounding newly formed stars of early spectral types were examined. The evolution of an H II region during the formation of the exciting star was considered, and it is shown that there are two modes of evolution. Physical processes governing the temperature structure and ionization structure of an H II region and an ionization front were investigated. Corrections to the growth rates for the instability of an ionization front were computed. There was an unsuccessful attempt to construct a statistical mechanics of sound waves in an isothermal gas. Author (TAB)

N66-31315# California Inst. of Tech., Pasadena.

ON SOME PREDICTED AND OBSERVED FEATURES OF QUASI-STELLAR SOURCES

John H. Bahcall 1966 28 p refs (Contract Nonr-220(47); Grant NSF GP-5391)

(AD-633013) CFSTI: HC $2.00/MF $0.50

The purpose of this paper is to correlate or explain some observed features of quasi-stellar sources in a way that enables one to predict with simple models: (a) the relative strengths of the Lyman lines ($n_p > 1$ is transitions in hydrogen) that may be observed and (b) the optical depth of the nebulae beyond the Lyman continuum ($h\nu > 13.6$ eV). Author (TAB)

N66-31340# Boeing Scientific Research Labs., Seattle, Wash. Geo-Astrophysics Lab.
ISOTHERMS IN THE EQUATORIAL REGION OF THE TOTALLY ECLIPSED MOON
J. M. Saari and R. W. Shorthill Apr. 1966 7 p refs
(DI-82-0530; AD-633033) CFSTI: HC $1.00/MF $0.50

Isothermal contours of the totally eclipsed moon are shown for the equatorial region. Location information is provided by a selenographic grid drawn to 1 degree increments of latitude and longitude. Fifty-five craters which are hot spots are identified by name. Author (TAB)

N66-31351*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DYNAMIC-MODEL STUDY OF PLANETARY-ENTRY CONFIGURATIONS IN THE LANGLEY SPIN TUNNEL
Peter J. Costigan Washington, NASA, Jul. 1966 23 p refs
(NASA-TN-D-3499) CFSTI: HC $1.00/MF $0.50 CSCL 22A

A study has been conducted in the Langley spin tunnel to determine the low subsonic speed stability and drag characteristics during vertical descent of a number of entry configurations being considered for probes of planetary atmospheres. The models tested were three of a series designated as tension shells, two blunted cones, a configuration similar to the Apollo command module, a sphere, a step-sphere, a hemisphere, and two modified spheres. The results of the study indicate that the tension shells had a limit-cycle oscillation of less than ±20° and had the highest drag coefficients of any of the configurations tested. These configurations would not return to erect positions if launched inverted, but would tumble after several increasingly large oscillations. An appendix treats the problem of scaling techniques necessary to simulate planetary environments other than that of the earth. Author

N66-31364*# Electro-Mechanical Research, Inc., Sarasota, Fla. Telemetry Div.
STUDY OF LUNAR GEOPHYSICAL SURFACE AND SUBSURFACE PROBES FOR APOLLO APPLICATION PROGRAM. VOLUME I: SUMMARY TECHNICAL REPORT Final Report
A. D. Robinson et al Jun. 1966 33 p
(Contract NAS8-20243)
(NASA-CR-76405) CFSTI: HC $2.00/MF $0.50 CSCL 03B

A preliminary design study was conducted on a family of instruments for observing specific properties of the lunar surface and subsurface. A summary of the guidelines, constraints, and philosophy used for the selection and design of the lunar experiments is presented. The recommended surface and subsurface experiments for the lunar geophysical probe system are outlined. The lunar geophysical probe system is described together with its instrumentation for the subsurface and surface experiments, and its telemetry, power, and weight requirements. R.N.A.

N66-31385*# Electro-Mechanical Research, Inc., Sarasota, Fla. Telemetry Div.
STUDY OF LUNAR GEOPHYSICAL SURFACE AND SUBSURFACE PROBES FOR APOLLO APPLICATION PROGRAM. VOLUME II: DETAILED TECHNICAL REPORT
W. Knopik et al Jun. 1966 471 p refs
(Contract NAS8-20243)
(NASA-CR-76413) CFSTI: HC $7.17/MF $2.00 CSCL 22A

Presented are the results of a preliminary design study of an integrated geophysical probe system for measuring specific properties of the lunar surface and subsurface during the Apollo Applications lunar surface missions. A survey of geophysical experiments was made and ten subsurface and six surface experiments were selected to provide scientific information relevant to the origin and history of the moon. This report describes in technical detail the instruments that were designed for conducting these experiments. H.S.W.

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N66-30123*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
EFFECTS OF ENERGY DISSIPATION ON THE FREE BODY MOTIONS OF SPACECRAFT
Peter W. Likins 1 Jul. 1966 77 p refs
(Contract NAS7-100)
(NASA-CR-76114; JPL-TR-32-860) CFSTI: HC $3.00/MF $0.75 CSCL 22B

The objective of this study is the development of methods of analysis of the motions of spacecraft modeled as nonrigid, dissipative bodies in a force-free environment. In the absence of external forces, angular momentum is conserved, but, because of internal energy dissipation effects, gross changes in body orientation and rotational motion may occur. Three analytical methods for the prediction of these changes are developed or described in this report. The first method, based on a model of a spacecraft as a rigid body with an "energy sink," is discussed and documented, and limitations in its application are noted. The second method involves the dynamical analysis of a discrete parameter model of a spacecraft, including discrete dampers. In the third method, a modal model is utilized; i.e., motions are described in terms of the normal modes of deformation of a slightly flexible, lightly damped structure. The primary advantage of this method stems from the improved likelihood of reasonable estimation of structural damping characteristics in early stages of design. Author

N66-30203# International Geophysical Year World Data Center A, Washington, D. C.
ROCKETS AND SATELLITES Catalogue of Data Received by WDC-A, 1 Jan. 1964–31 Dec. 1965
Mar. 1966 94 p refs

A catalog of rocket and satellite data is presented. Tables of sounding rocket launchings, meteorological rocket firings, and launching sites for sounding rockets are given. Scientists and institutions conducting sounding rocket experiments are listed by country. Artificial earth satellites and space probes launched for scientific purposes in the 1964–1965 period, and miscellaneous observations of satellites by visual, photographic, and radio methods from 1964 to 1965 are tabulated. Also included are author and subject indices of reports and reprints on compilations of positional observations; orbits, trajectories, and other motions; observation and tracking; instrumentation and data recovery; geodesy and gravity; atmospheric physics and composition; ionospheric physics; particles and corpuscular radiation; magnetic fields; electromagnetic radiation; meteorites; astronomy; biology; and bibliographies. R.N.A.

N66-30258*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
GEMINI SPACECRAFT PARACHUTE LANDING SYSTEM
John Vincze Washington, NASA, Jul. 1966 45 p
(NASA-TN-D-3496) CFSTI: HC $2.00/MF $0.50 CSCL 22B

The landing system consists of an 8.3-foot-diameter conical ribbon drogue, an 18.2-foot-diameter ringsail pilot, and an 84.2-foot-diameter ringsail main landing parachute. The significant new concepts proven in the Gemini Program for operational landing of a spacecraft include: (1) the tandem pilot/drogue parachute method of deploying a main landing parachute, and (2) attenuation of the landing shock by positioning the spacecraft so that it enters the water on the corner of the heat shield, thus eliminating the need for built-in shock absorption equipment. Author

N66-30309# International Geophysical Year World Data Center A, Washington, D.C.
ROCKETS AND SATELLITES Catalogue of Data, 1 Jan. 1964–31 Dec. 1965
Mar. 1966 98 p refs Sponsored by NSF

Reports dealing with sounding rockets, artificial earth satellites, and space probes are listed in a catalog of data received by the World Data Center during 1964 and 1965. Separate author indexes are presented for the various countries from which the reports originated. Subject indexes are categorized under such headings as: positional observations, orbits and trajectories, tracking, atmospheric physics, particles and corpuscular radiation, and magnetic fields. M.W.R.

N66-30327*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ANALYSIS OF THE MOTION OF A SATELLITE-REACTION WHEEL ASSEMBLY OPTIMIZED FOR WEIGHT AND POWER
C. R. Hayleck, Jr. Dec. 1965 33 p
(NASA-TM-X-55503; X-723-65-494) CFSTI: HC $2.00/MF $0.50 CSCL 22B

An analysis is presented of the slewing motion of a satellite and reaction wheel assembly during the execution of a slewing maneuver. The device analyzed obeys the law of conservation of momentum. Therefore any rotation of the reaction wheel is accompanied by a corresponding rotation of the satellite but in the opposite sense. The motion is analyzed for two satellite slewing rates −30° in 180 sec.; 2° in 30 sec. Three reaction wheel maximum speeds are considered −500, 1000, and 1500 revolutions per minute. Both sets of values were taken from reports on work done on this problem in the past and were selected for the purpose of giving comparative data. Based upon a typical maximum permissible torque, To, the reaction wheel mass moments of inertia, I, were calculated. From these values for I reaction wheel dimensions and weights were calculated and then optimized on the basis of minimum weight. Finally, on the basis of the optimized total weight, the power required was optimized for the reaction wheel speeds considered. The motor was assumed to have constant torque over the working range. Author

N66-30331*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BASIC DESIGN CONSIDERATIONS FOR A SMALL SCIENTIFIC SATELLITE
N. Logan Mar. 1966 14 p ref
(NASA-TM-X-55508; X-723-66-97) CFSTI: HC $1.00/MF $0.50 CSCL 22B

A detailed outline is presented giving considerations for the design and development of small scientific satellites. The following areas are covered: (1) the spacecraft itself; (2) the spacecraft/vehicle interface; and (3) ground handling equipment and transportation. D.T.

N66-30337*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SYSTEM FOR ORIENTING BALLOON PAYLOADS IN SPACE
S. M. Derdeyn and D. A. Kniffen Mar. 1966 19 p refs Submitted for Publication
(NASA-TM-X-55514; X-611-66-116) CFSTI: HC $1.00/MF $0.50 CSCL 22B

An inexpensive system for orienting balloon payloads to allow a detector to view a fixed position on the celestial sphere is described. The basic system is a sun seeker with programmed motion to correct for earth rotation and wind drift and to thereby provide relatively accurate orientation toward any desired direction on the celestial sphere. Two successful balloon flights have been flown utilizing this oriented platform, which can be used, with minor modifications, for a large number of applications. Author

N66-30340*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A TIMING EXPERIMENT USING THE GEOS SATELLITE OPTICAL BEACON
John E. Moye Mar. 1966 45 p refs
(NASA-TM-X-55517; X-524-66-149) CFSTI: HC $2.00/MF $0.50 CSCL 22B

During the months of February and March 1966, several passes of the GEOS satellite optical beacon flashes were observed photoelectrically at the Goddard optical research facility. A total of 32 flash lamp sequences were observed, recorded and timed relative to the NASA Goddard cesium beam standard. Results of the experiment verified that lamp flashes occur with sufficient accuracy at times programmed into the satellite memory, and indicate that the optical beacon may prove to be useful in checking and possibly synchronizing ground based clocks. Author

N66-30343*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BIOLOGICAL DECONTAMINATION OF A SPACECRAFT SYSTEM
F. N. Le Doux Apr. 1966 21 p Presented at the Am. Assoc. for Contamination Control Conf., Houston, Tex., 31 Mar. 1966 Submitted for Publication
(NASA-TM-X-55520; X-723-66-155) CFSTI: HC $1.00/MF $0.50 CSCL 22B

A 15 second brush-wash with xylene and rinse in isopropyl alcohol removed 100% of rosen flux deposits of from 73 to 113 milligrams. Kill effectiveness tests indicated that a 95% kill could be obtained by immersing components in a 90% isopropyl alcohol for 15 minute period. Xylene and alcohol were both found to be compatible with the electronic circuits and spacecraft materials. To determine the effectiveness of decontamination, control strips with detachable coupons were used for recovery from the electronic circuit modules, and sterile swabs and templates were used for other surfaces. A clean room complex was built that allowed for decontamination of spacecraft components, taking samples for assaying, and final assembly. The total viable count is determined by

adding the counts for different areas at the time of occlusion, the counts for all interior and exterior surfaces, and an estimate of the internal burden of components. Author

N66-30440# Boeing Co., Seattle, Wash.
EXPULSION OF WATER-BASED LIQUIDS INTO HARD VACUUM
Richard A. Dawley [1966] 56 p refs
(D2-84191-1)

This report presents the results of a test program to investigate the problem of expulsion of water-based liquids from a spacecraft into a hard vacuum. Four different discharge port configurations were tested at various flow rates, water temperatures, and initial nozzle tip temperatures. The program demonstrated that a freezing problem does exist, since all nozzles exhibited some icing and blockage. A converging nozzle with the shut off valve located at the skin showed a higher tendency to freeze than a straight discharge tube with the shut off located a few inches from the skin. Water temperatures above 70°F, high flow rates, and initial nozzle temperatures above 32° F allowed water discharge without stoppage due to freezing. The characteristic ice formations were recorded with photographs and motion pictures. Author

N66-30530*# Atkins and Merrill, Inc., Sudbury, Mass.
FEASIBILITY STUDY OF CONSTRUCTING A 1/10 SCALE APOLLO SERVICE MODULE SIMILITUDE MODEL Final Report
Christie T. Rembetsy Dec. 1965 119 p
(Contract NAS9-4567)
(NASA-CR-65426) CFSTI: HC $4.00/MF $0.75 CSCL 22B

A feasibility study was made of the development of construction techniques of a 1/10 dynamically scaled, geometrically similar, structural replica of the Apollo service module to measure effects of intense aerodynamic fluctuating pressures generated during boost flight. Details on the fabrication of honeycomb core material, sandwich construction, panel edgings, corner joint assemblies, screw fasteners, and radial beams are given. The honeycomb core material was subjected to a series of tests, i.e., flexure, plate shear, flatwise and edgewise compression, and peel tests; density, stiffness, and vibratory response of honeycomb sandwich panels and corner joint assemblies were also tested. Preliminary testing was begun on the effects of several adhesive applications on the damping of flat aluminum bars. Test data indicated that the 1/10 scale replica could be produced and that similitude can be attained. One problem area that was experienced was in high damping values obtained in honeycomb sandwich specimens. It was found that these were caused by the test methods. Test procedure corrections produced a reduction in the ratio of model to full scale damping from more than 10/1 to less than 2/1. L.E.W.

N66-30637*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
MOTION STUDY OF THE SUCTION DUCTING ON THE S-IC STAGE OF THE SATURN V VEHICLE
H. E. Fursdon 22 Jun. 1966 37 p
(NASA-TM-X-53471) CFSTI: HC $2.00/MF $0.50 CSCL 22D

The design motion requirements of the gimbal joints, sliding joints, and compensating joints for the S-IC feed system of the Saturn V vehicle were determined by kinematic analysis using an IBM 7040 data processing system. This analysis provided a precise method of determining the axial and angular motion of each bellows in the S-IC feed system for design purposes. The mathematical method of analysis developed in this report can be applied to future designs instead of the graphical methods presently used. Author

N66-30544*# Little (Arthur D.), Cambridge, Mass.
THERMAL SCALE MODELING OF THE TEMPERATURE CONTROL MODEL OF MARINER MARS 64
Frank Gabron and Robert W. Johnson 25 Jan. 1965 92 p
Prepared for JPL
(Contract JPL-950789)
(NASA-CR-76213; C-66-326) CFSTI: HC $3.00/MF $0.75 CSCL 22B

Experimental determinations of the equilibrium temperatures within a one-half scale thermal model (TSM) of the Mariner Mars 64 spacecraft bus are reported. A 0.43 TSM of the basic octagonal bus of the temperature control model (TCM) was fabricated and tested in a thermal-vacuum chamber. Tests are compared with those for the full-scale TCM under conditions of thermal similitude. The TSM configuration is described, and performance tests of a scaled thermal control louver assembly are discussed. The theory and preliminary tests used to determine the procedures for thermally scaling the bolted joints are presented. Some of the experimental results obtained were that more than 50% of the temperatures corresponded within 5°F and 90% corresponded within 10°F. Eliminating the heat leakage through small gaps between thermal shields resulted in a 5°F increase in the average temperature of the TSM. It was concluded that temperatures within a complex spacecraft can be predicted by use of temperature preservation thermal scale modeling techniques to an accuracy useful for the verification of thermal design concepts. S. P.

N66-30761*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
SUNBLAZER STATE DETERMINATION INVESTIGATION
Dennis O. Madl (M.S. Thesis) May 1966 84 p refs
(Contract NASr-249)
(NASA-CR-76312; CSR-T-66-4) CFSTI: HC $3.00/MF $0.75 CSCL 22B

Sunblazer is a small solar probe that will be tracked using signals received from an onboard transmitter. The measurable quantities are the azimuth and elevation angles of the probe and range-rate as inferred from a doppler frequency shift. These are measured in station coordinates at a single receiving station. A filter is developed for recursively estimating the probe state. The quality of the estimation procedure is investigated by computing the correlation matrix of estimation errors at probe conjunction, so that the sensitivity of the estimation uncertainties to uncertainties in range-rate data are determined. It is found that the estimation uncertainties of 4 of the 6 state components can be reduced to 20% of the value calculated without range-rate data. This requires that the residual frequency uncertainties, which are primarily a function of the onboard transmitter, be reduced to 1 part per 10^8. To achieve this, a second filter is developed for reducing short term frequency variations to a low level. Methods are also suggested for estimating the longer term transmitter drift. Author

N66-30762*# IIT Research Inst., Chicago, Ill. Astrosciences Center.
SPACECRAFT PROGRAM COST ESTIMATING MANUAL

W. P. Finnegan and C. A. Stone May 1966 20 p refs
(Contract NASr-65(06))
(NASA-CR-76263; C-7) CFSTI: HC $1.00/MF $0.50 CSCL 22B

An equation for estimating program costs for design, development, and manufacture of spacecraft has been empirically developed based on the number of complete spacecraft (full prototypes, flight spares, and flight models) and the weights of three spacecraft subsystems (telecommunications and data handling, structure, and propulsion). The accuracy of prediction is, of course, in part dependent upon the quality of the input data, but root mean square errors of less than ±30 percent have been demonstrated using program level information. The cost estimation method is intended for use in long range planning and this report summarizes definitions, presents examples, and supplies graphical aids for utilizing the equation developed. Author

N66-30788*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
AN INITIAL CONCEPT OF A MANNED MARS EXCURSION VEHICLE FOR A TENOUS MARS ATMOSPHERE
G. R. Woodcock 7 Jun. 1966 55 p refs
(NASA-TM-X-53475) CFSTI: HC $3.00/MF $0.50 CSCL 22B

This report summarizes a preliminary investigation of the requirements and characteristics of a manned Mars landing vehicle to: establish how much aerodynamic braking might be feasible with thin atmosphere; determine if parachutes appear feasible and, if not, how can aerodynamic braking be phased into rocket braking for a landing; and establish a rough estimate of the total mass of a Mars landing vehicle. Author

N66-30849*# Illinois Univ., Urbana. Coordinated Science Lab.
AERODYNAMIC TORQUE ON A SPINNING SPHERICAL SATELLITE WITH APPLICATION TO MEASUREMENT OF ACCOMMODATION COEFFICIENTS
Gerald R. Karr May 1966 60 p refs
(Grant NsG-443; Contract DA-28-043-AMC-00073(E))
(NASA-CR-76366; R-295) CFSTI: HC $3.00/MF $0.50 CSCL 22A

The aerodynamic torque on a spinning spherical satellite has been analyzed and the feasibility has been studied of either reducing the torque or, on the other hand, utilizing it to measure accommodation coefficients of satellite surfaces. From the results of the analysis, two conclusions were obtained. First, the precession resulting from the aerodynamic torque can be reduced to less than .2 sec of arc per year by orbiting at 600 miles or above and requiring the spin axis to be within 3° of the orbital plane. Second, accommodation coefficients of satellite surfaces can be measured by orbiting at 300 miles with the spin axis 45° out of the plane of the orbit. The nonuniform heating analysis shows that the effect is negligible in regard to the relativity experiment and possible measurement of the temperature dependence of accommodation coefficients requires greater accuracy in precession measurements than now proposed. It was also found that orbital regression effects can be reduced by suitable choice of the initial orbital parameters. Author

N66-30870# Compagnie Francaise Thomson-Houston, Paris (France).
PROSPECTS FOR TELEVISION SATELLITES [PERSPECTIVES EN MATIERE DE SATELLITES DE RADIODIFFUSION VISUELLE]
V. A. Altovsky 1 Oct. 1965 15 p In FRENCH; ENGLISH summary
CFSTI: HC $1.00/MF $0.50

The essential differences of application between telecommunication satellites and those for television are laid down. After explaining the difficulties encountered for the realization of the latter (energy problem, weak emission power, modifications of ground receivers etc.), the author concludes that television by satellites meets with considerable difficulties (congestion of Hertzian spectrum, danger of mutual interference between satellite emissions and those of existing ground networks) if it is conceived for television receivers of present standard. Through the adoption of new norms based on frequency modulation—especially in the case of educational programs—these satellites might be operational a few years from now in the U.S.A. I.M.

N66-30876# Brussels Univ. (Belgium). Inst. of Applied Mechanics.
PERIODS OF ECLIPSE OF A SATELLITE [PERIODES D'ECLIPSE D'UN SATELLITE]
A. Jaumotte and J. Pannewaert 1964 41 p In FRENCH; ENGLISH summary Prepared for ESRO
CFSTI: HC $2.00/MF $0.50

This note relates the period of eclipse during which a satellite is in the shadow or penumbra of the earth, to the orbit parameters. After reviewing several general aspects (definition of orbit, transformation of an equatorial reference system into an ecliptic one, influence of injection errors, etc.), the problem of an eclipse caused by the satellites ESRO I, ESRO II (for different dates and times of launching), and ASTROSAT is studied. I.M.

N66-30883*# Centre National de Recherches de l'Espace, Brussels (Belgium).
CONCERNING SATELLITE S66 [AU SUJET DU SATELLITE S66]
Jean-Louis Van Eck Apr. 1963 14 p In FRENCH; ENGLISH summary Presented at Congr. Intern. d'Electronique Quantique, Paris, 13 Feb. 1963 Sponsored by NASA *Its* Note Preliminaire No. 26
(NASA-CR-76377) CFSTI: HC $1.00/MF $0.50 CSCL 22B

The directivity and intensity of the laser beam will soon lead to great improvements in long-distance communications in interplanetary space as well as in the tracking and guidance of space vehicles. However, a number of problems remain, such as: signal-to-noise ratio (amount of energy lost during transmission), directional adjustment, deterioration of signal, etc. In order to obtain accurate experimental data regarding these questions, tracking tests will be carried out on the S66 satellite. The main purpose of this satellite, also called the Polar Ionosphere Beacon Satellite is the study of the electron density of the earth's atmosphere. The author quotes some technical data concerning this satellite (description, directional adjustment, electronics, reflector, etc.), and examines the problem of the laser tracking device. The author concludes that thanks to the reflector fitted to one of its faces, the S66 satellite may be used for many years, even after its solar cells are worn out. Author

N66-31191# European Space Technology Center, Noordwijk (Netherlands).
KINEMATICS OF SPACECRAFT LAUNCHING
J. Vandenkerckhove Paris, ESRO, Mar. 1966 49 p refs Lecture given at ESRO Summer School, Oxford, 11 Aug. 1964
(ESRO-TM-23) CFSTI: HC $2.00/MF $0.50

The performance of single-stage rockets is investigated, including a discussion of gravity losses, optimization of thrust law and burning time, and payload and propellant ratios. The requirements for different types of mission are stated, and the advantages and fundamental characteristics of multi-staging are discussed. Injection into orbit both by direct ascent and by Hohmann transfer function is described, and out-of-plane maneuvers are briefly discussed. The final chapter is concerned with the constraints influencing the choice of trajectories: geographical, including range safety constraints, and time constraints on launching for various missions. Brief mention is made of the constraints inherent in the guidance system. Author

N66-31211*# Goodyear Aerospace Corp., Akron, Ohio.
DESIGN STUDIES OF ADVANCED LENTICULAR PASSIVE COMMUNICATION SATELLITES FROM LOW TO SYNCHRONOUS ORBIT Report, May–Sep. 1965
Washington, NASA, Jul. 1966 211 p refs
(Contract NAS1-3114)
(NASA-CR-503) CFSTI: HC $6.00/MF $1.25 CSCL 22B

Parametric analyses were conducted on advanced gravity gradient stabilized lenticular satellite configurations to determine the effects of variations in orbital altitude, radius of curvature of the rf reflecting lens, and lens included angle on satellite physical characteristics and performance. Information is presented on equation development, assumptions, mode, and choice of constants or design factors used. Lens radius of curvature, lens included angle, and orbital altitude are shown to be key parameters for defining a satellite configuration. Representative configurations defined for low and synchronous orbits verified the validity of the design and performance assumptions. Acceptable stabilization performance can be achieved with the Ames X system at orbital altitudes of 1000 n. mi. to synchronous with the stabilization system being 10% of the satellite launch weight. Transient speed response and sensitivity to orbital eccentricity and solar pressure torque effects are acceptable. Stabilization error analyses of representative lenticular satellite configurations showed that transient damping capability of the satellite is better at high altitudes, that steady-state errors are performance limiting at synchronous altitude, and that some trade-off between transient damping capability and steady-state errors is possible, particularly at higher altitudes. R.N.A.

N66-31222*# General Electric Co., Philadelphia, Pa. Missile and Space Div.
VOYAGER SPACECRAFT SYSTEM STUDY (PHASE II SATURN V LAUNCH VEHICLE), VOLUME IIb Final Report
9 Dec. 1964 294 p Prepared for JPL *Its* Doc.-64SD4376
(Contracts NAS7-100; JPL 950847)
(NASA-CR-76370) CFSTI: HC $6.00/MF $1.50 CSCL 22D

Volume IIb is presented on the Saturn V launch vehicle as part of a systems study of the Voyager spacecraft. This volume discusses alternate design approaches, test requirements and facilities, the spacecraft program schedule, and spacecraft cost estimates. R.N.A.

N66-31313# Lincoln Lab., Mass. Inst. of Tech., Lexington.
POSITION ERROR IN STATION-KEEPING SATELLITE
Brian J. Moriarty 1 Apr. 1966 18 p *Its* Tech. Note 1966-21
(Contract AF 19(628)-5167)
(ESD-TR-66-159; AD-633034) CFSTI: HC $1.00/MF $0.50

An automatic station-keeping satellite must be able to measure its deviation from the nominal position. For the system considered here (an equatorial synchronous orbit) this involves a latitude difference measurement between the earth and sun at certain times. This report shows that a combination of an error in satellite orientation and the sun being in a plane other than the equatorial plane may result in errors in position determination. The nature of the errors involved is described and their magnitudes estimated. Author (TAB)

N66-31350*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ORIGIN OF HIGH-INTENSITY NOISE IN THE AREA OF A LARGE PROTUBERANCE ON A LAUNCH VEHICLE
Michael L. Nacht and Raymond A. Turk Washington, NASA, Jul. 1966 16 p ref
(NASA-TM-X-1261) CFSTI: HC $1.00/MF $0.50 CSCL 22D

A 1/10-scale Atlas-Agena-Mariner C was tested in the Lewis 10- by 10-foot wind tunnel over a Mach number range of 2.0 to 2.5 at an angle of attack of 0°. Attention was centered on the fluctuating pressure activity in the area of an equipment pod. Power-spectral-density analyses failed to reveal distinct power spectra levels at model frequencies corresponding to full-scale frequencies where significant power concentrations had been observed. This indicates the possibility that these large flight vibratory levels may be caused by pressure fluctuations that excite vehicle structures at their natural resonant frequencies. Root-mean-square fluctuating pressure studies revealed that flow separation and shock-boundary layer interaction may contribute significantly to the general level of pressure fluctuations on launch vehicles. Author

N66-31358*# National Aeronautics and Space Administration, Washington, D. C.
LUNAR ORBITER A
29 Jul. 1966 66 p
(NASA News Release-66-195) Available from the Scientific and Technical Information Division CSCL 22B

This report describes the Lunar Orbiter spacecraft, its camera system, photo taking process, photo processing system, photo readout process, electric power system, attitude control system, velocity control system, communications system, and temperature control system. The orbiter's tasks of lunar photography, selenodesy, and meteoroid and radiation measurements are discussed. Also included are descriptions of the Atlas-Agena D launch vehicle, data acquisition and evaluation by the Deep Space Network, and the sequence of events from launch to final photographic orbit injection. R.N.A.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N66-29994# General Electric Co., Philadelphia, Pa. Missile and Space Div.
STRUCTURAL EFFICIENCY OF COMPOSITE MATERIALS FOR AIRCRAFT APPLICATIONS

Norris F. Dow and B. Walter Rosen Apr. 1966 52 p refs Presented at the AIAA/ASME 7th Struct. and Mater. Conf., Cocoa Beach, Fla., 18–20 Apr. 1966
(Contract AF 33(615)-2447)
(R66SD22; AD-632492) CFSTI: HC $3.00/MF $0.50

Evaluations are made of the potential of filamentary composites for aircraft wing beams, including stiffened, multi-web, and sandwich construction. Throughout, the approach used employs the 'structural index' concept, in which the structural efficiency is related directly to the design loading conditions. The results define areas in which advanced composites have the greatest potential for improvements in aircraft structural efficiency. Author (TAB)

N66-30086# Joint Publications Research Service, Washington, D. C.
CALCULATING MANOMETRIC SPRINGS WITH VARIABLE WALL THICKNESS
M. P. Shumskiy *In its* Izv. VUZov: Instr. Bldg. 27 Jun. 1966 p 133–138 refs (See N66-30046 17-10) CFSTI: $5.00

We consider an approximate solution to the problem of stresses and displacements for manometric springs with variable wall thickness. It is shown that springs with variable wall thicknesses have larger movements for smaller stresses in comparison with ordinary springs. Author

N66-30079*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A PRETENSIONING CONCEPT FOR RELIEF OF CRITICAL LEADING-EDGE THERMAL STRESS
Jerald M. Jenkins Washington, NASA, Jul. 1966 27 p refs (NASA-TN-D-3507) CFSTI: HC $1.00/MF $0.50 CSCL 20K

The concept of pretensioning high-temperature leading edges is demonstrated. Elementary equations are presented and applied, by means of an example problem, to a mathematical model of a leading-edge system in order to illustrate the mechanics of the concept. The results of the example problem show that leading-edge pretensioning significantly reduces the magnitude of critical compressive thermal stress in the leading-edge stagnation region. The general concept of pretensioning offers a new approach to reducing the magnitude of critical operating leading-edge stress. The increased overall margin of safety and the more efficient use of the entire leading-edge cross section is illustrated in the example problem. Author

N66-30096# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE DYNAMIC FIELD OF STRESSES IN AN ELASTIC HALF-SPACE UNDER THE ACTION OF AN AXIALLY SYMMETRIC DISTRIBUTED LOAD
V. S. Nikiforovskiy *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 149–155 refs (See N66-30086 17-23)

Work on the study of dynamic state of stress condition of an elastic isotropic half-space under influence of a surface load is considered. Basic results obtained in the problem on the influence of a vertical concentrated force on the half-space are presented. However, of practical value is a load distributed over a certain area. The formulation of the problem is analogous to previous studies, but with the load distributed on the surface, thus providing the possibility of making a more complete investigation of the stress state of an elastic half-space and defining the mechanism of load of the latter more accurately. Author

N66-30097# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOLUTION OF THE PROBLEM OF THE STABILITY OF A COMPRESSED SHELL UNDER CONDITIONS OF CREEP ACCORDING TO THE HYPOTHESIS OF HARDENING
A. P. Kuznetsov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 166–179 refs (See N66-30086 17-23)

The hypothesis of hardening for the solution of the boundary of stability is used to describe the creep of aluminum alloys under varying stresses. The intensity of creep flow is determined, and equations of motion are presented for a shell under conditions of creep. Intensities of the stresses and rates of creep strains are expressed, and the critical deformation of a shell is determined. The symmetrical case of buckling during longitudinal compression is examined. It is pointed out that the method discussed for determining the boundary of the stability is conditional, since different boundaries of the stability can be obtained by proceeding with different initial perturbations at the initial moment of time. S. F.

N66-30175*# California Univ., Berkeley. Structural Engineering Lab.
FINITE ELEMENT SOLUTION OF AXISYMMETRICAL DYNAMIC PROBLEMS OF SHELLS OF REVOLUTION
H. Y. Chow and Egor P. Popov Apr. 1966 53 p refs
(Grant NsG-274)
(NASA-CR-76100; SESM-66-3) CFSTI: HC $3.00/MF $0.50 CSCL 20K

A finite element solution for the natural frequencies and mode shapes of free axisymmetrical vibrations and the dynamic response of arbitrary rotationally symmetric shells is presented. The stiffness for the basic annular plate, conical and cylindrical elements are constructed using the static homogeneous solutions of the classical plate and shell bending theories. The mass matrix for the annular plate is based on the same solutions. For the conical and the cylindrical elements the mass matrix is determined using an assumed displacement field. The developed solutions were programmed in Fortran IV. The illustrative examples include a detailed analysis of a problem of a shallow spherical cap subjected to an axisymmetrical pressure varying with time, a solution for a plate subjected to a time-dependent ring load and an analysis of a dynamic response of a complete sphere. Author

N66-30215# MSA Research Corp., Evans City, Pa.
EFFECT OF HIGH-TEMPERATURE SODIUM ON AUSTENITIC AND FERRITIC STEELS Quarterly Progress Report, Oct.-Dec. 1965
17 Jan. 1966 30 p ref
(Contract AT(11-1)-765)
(MSAR-66-09) CFSTI: HC $2.00/MF $0.50

Results of creep-rupture tests and fatigue tests at high cyclic strain levels for type 304 stainless steel exposed to high-carbon and high-oxygen sodium at 1200°F are given. NSA

N66-30229# General Dynamics Corp., San Diego, Calif. John Jay Hopkins Lab. for Pure and Applied Science.
A RESEARCH PROGRAM ON THE EFFECT OF SUBSTRUCTURE ON THE IRRADIATION STABILITY OF ASTM A302 GRADE B STEEL Quarterly Progress Report No. 2
T. A. Trozera and P. W. Flynn 8 Oct. 1965 14 p ref
(Contract AT(04-3)-167)
(GA-6724; EURAEC-1513) CFSTI: HC $1.00/MF $0.50

The new section of ASTM A302-B steel was cut to provide samples for testing. Tensile specimens in the three principal directions were cut at four points in the section and tested to characterize the section. The lower yield point and stress at maximum uniform strain were ±2% in the worst case, while the maximum uniform strain ranged from 0.10 to 0.14. Prestrains of 0.03, 0.06, and 0.09 combined with 1-hr heat treatments at temperatures of 375, 425, and 475°C caused the lower yield stress to increase from 16% to 41%, with decreases in maximum uniform strain of from ~0.13 (as-received) to within the range 0.06 to 0.11. Material from the section of A302-B previously tested was prestrained 0.03 and 0.06 and heat-treated 1 hr at 475°C. Charpy impact tests showed a 4 and 36°C NDT temperature increase for the 0.03 and 0.06 prestrains, respectively. Author (NSA)

N66-30250# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.

OPTIMUM DEPTH—MINIMUM AREA DESIGN CHARTS FOR LATERALLY SUPPORTED STRUCTURAL BEAMS IN PURE BENDING

Peter St. Clair Christie (M.S. Thesis) 9 Dec. 1965 146 p refs
(AD-631555) CFSTI: HC $4.00/MF $1.00

The investigation attempts to establish 'minimum' weight beam proportions, based on beam web elastic buckling criteria, for unstiffened I beams in pure bending. The investigation is basically a study of the parameters affecting beam weight for both strength and deflection designed beams. It is shown that an 'optimum' beam depth exists at which the beam cross sectional area will be 'minimum' for both strength designed and deflection designed beams. Design charts are prepared which enable the beam designer to select the lightest weight beam depth for the design moment load and for the design stress level that the beam can sustain. Author (TAB)

N66-30270# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.

DYNAMIC RESPONSE OF A VISCOELASTIC CYLINDER WITH ABLATING INNER SURFACE Interim Report

Jan D. Achenbach Dec. 1965 34 p refs
(Contract Nonr-1228(34))
(TR-65-6; AD-481014)

The effects of viscoelasticity and material ablation on the vibratory response of a long hollow cylinder are investigated. The cylinder is subjected to a time-dependent internal pressure. For step internal pressure, explicit solutions are presented for the circumferential stress at the eroding inner surface and for the displacement in radial direction. It is found that due to ablation, the instantaneous frequency decreases and the displacement amplitude increases. The increase in amplitude is counteracted by viscoelastic damping. In the analysis it is assumed that the material is incompressible in bulk and viscoelastic in shear according to the standard linear solid. Author (TAB)

N66-30271# Northwestern Univ., Evanston, Ill. Structural Mechanics Lab.

TORSIONAL OSCILLATIONS OF AN ENCASED HOLLOW CYLINDER OF FINITE LENGTH

Jan D. Achenbach Feb. 1966 20 p refs
(Contract Nonr-1228(34))
(TR-66-3; AD-481013)

A hollow elastic or viscoelastic cylinder of finite length is encased in a thin elastic shell. The analysis of free torsional vibrations of the elastic system yields a transcendental frequency equation that is solved numerically. The modes of free torsional motion are discussed and the proper relation establishing orthogonality of the principal modes is determined. The elementary mode of a free circular cylinder, when each transverse section rotates as a whole, does not occur for an encased cylinder. The exact frequencies are compared with estimates based on the assumption that the material of the core is very compliant as compared to the material of the shell. The regions are discussed in which these estimates are acceptable. Fourier–Bessel analysis is used for the problem of forced torsional motion of the encased elastic core, for arbitrary dependence on radial coordinate and time of the prescribed displacements or stresses at the end-sections. For time-harmonic forcing functions the analysis is extended to forced torsional motion of an encased viscoelastic cylinder. The viscoelastic solutions are derived in terms of the complex shear modulus. The analysis of this paper is of interest for application in solid-rocket technology. Author (TAB)

N66-30275# Polytechnic Inst. of Brooklyn, N. Y. Dept. of Aerospace Engineering and Applied Mechanics.

ON THE ACCURACY OF SOME DYNAMIC SHELL THEORIES

Anthony E. Armenakas Feb. 1966 52 p refs
(Contract Nonr-839(40) FBM)
(PIBAL-910; AD-481912)

The error in the frequency and mode shape obtained on the basis of the Flugge bending theory and a Donnell-type dynamic theory is established as a function of the shell parameters for modes having a small number of circumferential waves. The effect on the frequency of the axial and tangential inertia is evaluated. Simple but accurate expressions for the frequency of the first mode are presented and discussed. Author (TAB)

N66-30430# United Kingdom Atomic Energy Authority, Risley (England). Reactor Group.

MECHANIZED STRUCTURAL ANALYSIS: USER'S GUIDE TO THE GRID-FRAME PROGRAM

D. A. Jobson, J. A. Enderby, and J. P. Ellington 1966 48 p refs
(TRG-1089(R)) HMSO: 5s 6d

The aim of this report is to enable engineers who may have no experience of computers to use a program GRID-FRAME, which has been written in Fortran IV for an IBM 7090. GRID-FRAME will carry out a complete linear elastic analysis of most skeletal structures which initially lie in one plane, when subjected to any three-dimensional system of joint loads. The program will deal with anything from a simple beam to a structure of 600 members, and calculates the distorted shape under specified loads and restraints from a definition of the members and the connections between them. It takes into account member extension, bending, shear and twisting, where appropriate, printing out the forces and couples associated with each, together with the nodal point deflections and rotations. Author

N66-30441# Library of Congress, Washington, D.C. Aerospace Technology Div.

ELASTIC VIBRATIONS OF A CYLINDRICAL SHELL FILLED WITH LIQUID [OB UPRUGIKH KOLEBANIYAKH TSILINDRICHESKOY OBOLOCHKI, NAPOLNENNOY ZHIDKOST'YU] Surveys of Soviet Scientific and Technical Literature

T. Ye. Shashkov 16 Feb. 1965 17 p refs Transl. into ENGLISH from Inzh. Zh. (USSR), v. 5, no. 3, 1965 p 575–579
(ATD-66-16)

Approximate solutions of the natural vibration frequencies were obtained for two cases of a liquid filled, elastically vibrating cylindrical shell. In one case the shell is of infinite length and the liquid is compressible; in the other case the shell is of finite length, and it contains and/or is immersed in liquid. In addition, solutions were obtained for the flutter and dynamic stability of a cylindrical shell filled with liquid. D.T.

N66-30513# Bureau of Ships, Washington, D. C.
DESIGN OF STRESSED CONSTRUCTION ELEMENTS MADE OF SYNTHETICS [GRUNDLAGEN FUR DIE BERECHNUNG DEFINIERT BEANSPRUCHTER BAUTEILE AUS KUNSTSTOFF]
W. Knappe Nov. 1965 23 p refs Transl. into ENGLISH from VDI (Ver. Deut. Ingr. Z. (Dusseldorf), v. 107, no. 20, Jul. 1965 p 853–861
(AD-624432) CFSTI: HC $1.00/MF $0.50

Stress–strain characteristics, viscoelastic behavior, and deformation of synthetics used as stressed construction components are discussed. Stress–strain diagrams are presented for brittle synthetics and for cold stretchable thermoplastics. Differences between synthetics and metals, especially steel, are pointed out. The theory of linear viscoelasticity for small uniaxial deformations of synthetics is examined. Calculation of small temporary deformations by referring to the thrust and elasticity moduli determined at medium frequencies is considered. A method is proposed for measuring design parts in such a way that within a prescribed period certain admissible stresses will not be exceeded. S.P.

N66-30596*# California Univ., Los Angeles.
OPTIMUM DESIGN OF COLUMNS SUPPORTED BY TENSION TIES
Hagen Richard Mauch (M.S. Thesis) 1966 150 p refs
(Grant NsG-423)
(NASA-CR-76245) CFSTI: HC $4.00/MF $1.00 CSCL 20K

A method of analysis is summarized and a procedure is presented for optimizing tension-tie supported thin walled cylindrical columns. The optimized column for a given structural index is defined by a particular diameter, wall thickness, tie prestress, tie cross sectional area, tie angle, and strut dimensions. For the cases considered, it is found that, in the low range of the structural index, the tie supported column offers a potential weight savings of up to 50% over the simple tubular column. Author

N66-30647# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A PRELIMINARY STUDY OF THE BUCKLE CONTOURS IN AN AXIALLY COMPRESSED CIRCULAR CYLINDRICAL SHELL
W. H. Horton and R. W. Johnson Dec. 1965 31 p refs
(Contract DA-44-177-AMC-115(T))
(SUDAER-253; AD-632920) CFSTI: HC $2.00/MF $0.50

The paper presents experimentally determined contours at initial buckling for an aluminum right circular cylindrical shell of 3.35 inches of diameter and 0.0025 inches wall thickness loaded in axial compression. It shows that when the buckle amplitude is only 2.8 times the wall thickness there is strong evidence of plastic deformations. Author (TAB)

N66-30650# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
NONSYMMETRIC BUCKLE PATTERNS IN PROGRESSIVE PLASTIC BUCKLING
W. H. Horton, S. C. Bailey, and A. Edwards [1965] 51 p refs Presented at the SESA Meeting, Denver, 1965 Submitted for Publication
(Contracts DA-44-177-AMC-115(T); AF 49(638)-1495)
(AD-632922) CFSTI: HC $2.00/MF $0.50

This paper presents the results of a series of experiments on the progressive plastic buckling of cylindrical shells under axial compressive load. It shows that for shell bodies with an R/t less than 100 the normal axisymmetric ring buckling will develop into nonsymmetric patterns. We demonstrate that there exist also a class of shells within this thickness-radius range for which nonsymmetric plastic buckling always occurs without the prior formation of a ring. It appears from the limited number of tests made that for a particular R, R/t, material and rate of loading there is a critical value of L, above which where is a high probability of the buckle pattern developing in a nonsymmetric fashion, it seems probable, too, that there are bands of R/t for a particular L/R, R, material and rate of loading for which the buckle number will be constant. The experiments tend to indicate that the postbuckling efficiency of the shell decreases with increasing buckle number. The nonsymmetric patterns demonstrated appear to be inextensional deformations, they are very similar in character to the Yoshimura-pattern which occurs as the limiting case for thin shells in axial compression and under impact loading. Load displacement histories are presented for some of the various modes of failure demonstrated. TAB

N66-30657# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.
PRELIMINARY FLUTTER ANALYSIS. VOLUME I: WING
Nov. 1965 186 p
(Contract DA-49-177-TC-715)
(Rept.-163; AD-633019) CFSTI: HC $5.00/MF $1.00

Results of the overall CEA analysis indicated that the XV-5A aircraft (wing), on the basis of the preliminary data utilized in the analysis, is free of flutter within the proposed flight envelope. Studies showed that mass-balancing of the aileron is a critical factor, and must be carefully evaluated for future design efforts on the XV-5A aircraft. Similarly, the overall spring restraint does affect the flutter characteristics, but the variation, at most, will still lie above 15% on V_L or M_L. The flutter mode, that of antisymmetric wing bending coupled with aileron rotation, indicates that proper aircraft simulation must be used in future flutter evaluation of the XV-5A aircraft with due attention given to fuselage and/or aircraft degrees of freedom. Author (TAB)

N66-30673# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.
XV-5A LIFT FAN FLIGHT RESEARCH AIRCRAFT PROGRAM. PRELIMINARY FLUTTER ANALYSIS. VOLUME II: EMPENNAGE
Dec. 1965 129 p refs
(Contract DA-44-177-TC-715)
(Rept.-163; AD-633020) CFSTI: HC $4.00/MF $1.00

Results of the empennage flutter analysis indicate a possible flutter situation existing within the design flight envelope of the XV-5A aircraft. The flutter mode is characterized by horizontal tail pitch coupled with basically symmetric horizontal tail bending for low values of pitch frequencies (40 cps) and for pitch coupled with horizontal tail torsion at pitch frequencies greater than 40 cps. The required pitch frequency

would be of the order of approximately 55 cps for a flutter velocity margin of 15% of the design limit dive speed at sea-level, which is the critical altitude. Establishment of the actual pitch frequency through experimental methods is required for definite determination of flutter margins. The analyses presented in this report should be taken as a preliminary evaluation of the empennage of the XV-5A aircraft. Subsequent analytical and experimental investigations should then be directed toward finalization of the actual flutter characteristics of the XV-5A aircraft, with due regard for the findings of the studies presented in the report. Author (TAB)

N66-30674# General Electric Co., Cincinnati, Ohio. Advanced Engine and Technology Dept.

XV-5A LIFT FAN FLIGHT RESEARCH AIRCRAFT PROGRAM. PRELIMINARY FLUTTER ANALYSIS. VOLUME III: CONTROL SURFACES

Dec. 1965 117 p refs

(Contract DA-44-177-TC-715)

(Rept.-163; AD-633021) CFSTI: HC $4.00/MF $0.75

Equations of motion and stability equations are formulated using lumped spring-mass idealization and incompressible strip theory aerodynamics; control system elasticity and inertia are taken into account. One altitude only, sea level, is investigated. Solutions of the stability equations are obtained, giving flutter frequencies and complex damping coefficients required to maintain flutter as functions of flutter velocities for various values of stiffness parameter, both with and without aerodynamic balancing (centering) of the control surface. Both a symmetric and an antisymmetric analysis of the aileron–aileron flight tab aileron control system are made. An analysis of the rudder–rudder trim tab rudder control system is included and a symmetric analysis of the horizontal stabilizer–elevator–elevator control system is also made. Author (TAB)

N66-30724# Army Materials Research Agency, Watertown, Mass. Materials Engineering Div.

FREQUENCIES AND MODE SHAPES FOR AXISYMMETRIC VIBRATION OF SHELLS

Edward W. Ross, Jr. and William T. Matthews Feb. 1966 27 p refs

(AMRA-TR-66-04; AD-633343) CFSTI: HC $1.00/MF $0.50

This report treats the axisymmetric vibration of thin elastic shells. Estimates of natural frequencies and mode shapes are obtained for a general class of thin shells by applying the approximations obtained in a previous paper by one of the authors. Numerical results are obtained for ellipsoidal shells, and one new theoretical result is found. Author (TAB)

N66-30741# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.

THE STABILITY OF THIN-WALLED UNSTIFFENED CIRCULAR CYLINDRICAL SHELLS UNDER NONUNIFORMLY DISTRIBUTED AXIAL LOAD

W. H. Horton and J. W. Cox Feb. 1965 91 p refs Presented at 1965 ASME Aviation and Space Conf., Los Angeles, Calif., 16–18 Mar. 1965

(Contracts DA-44-177-AMC-115(T); DA-44-177-AMC-258(T))

(SUDAER-220; AD-632921) CFSTI: HC $3.00/MF $0.75

This paper presents an experimental study of the stability of thin-walled unstiffened circular cylindrical shells under nonuniformly distributed axial load. It shows that such shells will buckle when the stress at any point on their surface reaches the critical value for uniform axial compression. It is furthermore demonstrated that statistical data with regard to shell buckling can be obtained from limited tests on single specimens. TAB

N66-30750*# General Dynamics/Convair, San Diego, Calif. Advanced Structures Group.

STUDY OF STABILITY OF UNPRESSURIZED SHELL STRUCTURES UNDER STATIC LOADING, VOLUME I Final Report

George W. Smith and Frank A. Dittoe 21 Apr. 1966 169 p refs

(Contract NAS8-11181)

(NASA-CR-76254; GDC-DDG66-008, Vol. I) CFSTI: HC $5.00/MF $1.00 CSCL 20K

The primary intent of this study was to employ orthotropic shell theory to develop practical working tools for the prediction of instability in stiffened circular cylindrical shells subjected to axial compression. Emphasis is on approximate analysis techniques to be used in preliminary sizing, rough checking, and the study of trends. Methods for the more stringent requirements of final analysis are also discussed and a digital computer program is provided for such applications. In addition to considering the overall buckling strength of the stiffened shell, curves are also presented for predicting the buckling of curved isotropic skin panels such as those found between stiffening elements. Theoretical and empirical foundations for the proposed methods and concise procedures for their practical application are given. Author

N66-30757*# General Dynamics/Convair, San Diego, Calif. Research, Development and Engineering Dept.

STUDY OF STABILITY OF UNPRESSURIZED SHELL STRUCTURES UNDER STATIC LOADING, VOLUME II Final Report

George W. Smith and Frank A. Dittoe 21 Apr. 1966 464 p

(Contract NAS8-11181)

(NASA-CR-76325; GDC-DDG66-008, Vol. II) CFSTI: HC $7.63/MF $2.25 CSCL 20K

The primary intent of this study was to employ orthotropic shell theory to develop practical working tools for the prediction of instability in stiffened circular cylindrical shells subjected to axial compression. Emphasis is on approximate analysis techniques to be used in preliminary sizing, rough checking, and the study of trends. Methods for the more stringent requirements of final analysis are also discussed and a digital computer program is provided for such applications. In addition to considering the overall buckling strength of the stiffened shell, cures are also presented for predicting the buckling of curved isotropic skin panels such as those found between stiffening elements. The theoretical and empirical foundations for the proposed methods are furnished, while concise procedures for the practical application of these methods are presented. Author

N66-30786*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.

ON THE IMPACT INDUCED STRESS WAVES IN LONG BARS

S. Utku 15 Jul. 1966 29 p refs

(Contract NAS7-100)

(NASA-CR-76293; JPL-TR-32-932) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The work presented in this report is confined to the initial impactive behavior of uniform prismatic bars of constant pre-impactive velocity. Various nonlinear stress-strain relationships with no strain-rate effect are considered. The fact that the bar is laterally unconfined is taken into account in the equation of conservation of mass. The lateral motion is ignored; however, its effect is discussed during the derivation of Rankine–Hugoniot equations for the impacting bar of strain-hardening material. For the case of no strain hardening, the analysis in an Eulerian reference system is carried out with the method of characteristics until the occurrence of first unloading. Various formulas are derived for the possible iterative

computation of stresses, strains, and velocities. The general behavior of energy dissipators is studied by means of a bar of elastoplastic material with infinite strain hardening. It is shown that the bar will be crushed from both ends and, provided that lateral motion is prevented, it is also shown that the shock temperatures are helpful in energy dissipation. This paper indicates the number of measurements required for obtaining the first estimate of mechanical properties of the unknown impacted surface when the properties of the impacting bar are known. Author

N66-30787*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
COMPUTATION OF STRESSES IN TRIANGULAR FINITE ELEMENTS
Senol Utku 15 Jun. 1966 37 p refs
(Contract NAS7-100)
(NASA-CR-76292; JPL-TR-32-948) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The work described in this report is concerned with the calculation of stresses in linear thin shells of aeolotropic material using the deflections obtained by the finite-element method. When displacements and rotations of a thin shell or plate middle surface are known at sufficiently many nodal points, approximations for the stress resultants and couples may be computed by (1) distributing the nodal forces and moments of a triangular element along nodal lines, (2) obtaining a best-fit deflection field in the triangle from the available nodal deflections and using this field in the computation of strains and curvature changes, (3) obtaining best-fit displacement distributions along nodal lines from available nodal deflections and computing the components of best-fit strain and curvature-change tensors at nodes by least-squares from these distributions, and, finally, (4) combining the methods described in (2) and (3). Methods (1) and (2) enable one to keep the modular character of the finite element scheme. Methods (3) and (4) are semimodular, since they require information at all the neighboring nodes in order to compute the stresses at a node. These methods are formulated and discussed, and it is shown that the curvatures of the middle surface may be taken into account in all four instances. Author

N66-30792*# North American Aviation, Inc., Los Angeles, Calif.
STUDY OF SHELL SUPPORTED RING FRAMES WITH OUT-OF-PLANE LOADING Final Report, 24 Jun.-28 Dec. 1965
P. E. Bisch, E. Baumann, and G. H. Arvin 3 Mar. 1966 476 p refs
(Contract NAS8-20097)
(NASA-CR-76274; NA-65-1015) CFSTI: HC $7.76/MF $2.25 CSCL 20K

This study was conducted to provide an analytical tool for solving the deflections and internal loading distribution of ring frames in cylindrical shells when the rings are directly loaded by out-of-plane loadings and are supported by the shell. The theoretical solution of the problem is developed, using finite difference principles, in which the structure is divided into small beam elements. A mathematical solution is developed for the general case of integrating a structure from such elements by treating the interrelationship between elements in a rigorous manner. The general solution was adapted to the uniform circular ring supported by a shell and loaded out of plane, and translated into a specific matrix algebra readily programmable for a digital computer. The digital computer program was used to produce the unit frame response curves compiled in Appendix I. The solution was condensed into two variable parameters GJ/EI and C/R, which are elastic/geometric properties of the structure and are defined in the text. For a suitable range of each parameter, frame internal loadings and deflections responsive to out-of-plane loadings are presented for each station around the ring circumference. R.N.A.

N66-30802# Catholic Univ. of America, Washington, D. C.
IMPULSIVELY LOADED STRAIN-RATE-SENSITIVE PLATES
Nicholas Perrone May 1966 27 p refs
(Grant NSF GK-782)
(Rept.-1)

The response of an impulsively loaded isotropically rate-sensitive annular plate is calculated via "exact" and approximate viewpoints. For a typical example numerical results differed by about 3 per cent. The essence of the approximate approach, which represents a natural extension of a previous one dimensional analysis [1][2] is that the initial stress profile remains substantially constant during the dominant portion of plastic flow. Author

N66-30906# Westinghouse Electric Corp., Pittsburgh, Pa. Bettis Atomic Power Lab.
DUZ-1—A PROGRAM FOR SOLVING AXISYMMETRIC AND PLANE ELASTICITY PROBLEMS ON THE PHILCO-2000
D. S. Griffin, R. B. Kellogg, W. D. Peterson, and A. E. Summer, Jr. Nov. 1965 111 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-555) CFSTI: HC $4.00/MF $0.75

DUZ-1 is a digital computer program to solve two-dimensional planar and axially symmetric elasticity problems. Loading conditions may arise from nonuniform temperatures, body forces, and boundary displacements or forces. Up to 5000 points are allowed, with variable mesh and diagonal boundaries. Author (NSA)

N66-31040# Westinghouse Electric Corp., Pittsburgh, Pa. Research Labs.
STRESS DISTRIBUTION IN A PRESSURIZED CYLINDER WITH EXTERNAL LONGITUDINAL NOTCHES
M. M. Leven Aug. 1965 41 p refs
(Contract AT(11-1)-GEN-14)
(WERL-1114-2) CFSTI: HC $2.00/MF $0.50

A cylindrical vessel with four external longitudinal notches was subjected to internal pressure. The results of a photoelastic analysis of the principal stresses along the section of symmetry of six transverse sections through the shortest and most shallow notch are presented. The maximum stresses at the tip of the notch were found to be 20.0 times the nominal stress S in the circumferential direction and 7.1 S in the longitudinal direction. A maximum radial stress of about 3.0 S was developed at a distance of 1.7 times the radius from the notch tip. The stress field parameter for brittle fracture was found to vary from 0.73 to 0.97 as calculated by various methods. Author (NSA)

N66-31195# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.
AN EXPERIMENTAL INVESTIGATION OF THE DAMPING PROPERTIES OF AQUAPLAS UNDER RANDOM AND HARMONIC EXCITATION
D. J. Mead and A. J. Pretlove Jun. 1961 62 p refs
(AASU-173) CFSTI: HC $3.00/MF $0.50

The linearity of the damping and stiffness of Aquaplas F102B damping treatment is proved by tests on a two-layer

plate, by comparing dynamic properties measured under harmonic and random conditions. Results are used to predict random stress reductions due to Aquaplas being applied to a simple skin-stringer model vibrating under random forcing. Effect of treatment on mode is fully considered, in theory. R.M.S. stress reductions of up to 90% were measured on the model, along rivet lines. Limited agreement between prediction and measurements was obtained. Author

N66-31197# Southampton Univ. (England). Dept. of Aeronautics and Astronautics.

CRITERIA FOR COMPARING THE EFFECTIVENESS OF DAMPING TREATMENTS

D. J. Mead Jun. 1960 44 p refs

(USAA-125)

Criteria have been deduced indicating the effectiveness of a damping treatment in attenuating bending stresses, accelerations, inertia forces and sound pressure transmitted associated with simple vibrating plates under harmonic and random excitation. Coincidence sound transmission through plates is also considered. The importance is emphasized of including in these criteria the factors by which the damping treatment increases the mass and stiffness of the system. Three different commercial treatments have been compared using some of the criteria and it has been shown that the treatment providing the highest loss factor increment to the system is not necessarily the most effective in reducing all the response quantities. Author

N66-31214*# Martin Co., Denver, Colo.

BUCKLING OF CYLINDRICAL SHELL END CLOSURES BY INTERNAL PRESSURE

G. A. Thurston and A. A. Holston, Jr. Washington, NASA, Jul. 1966 27 p refs

(Contract NAS1-4782)

(NASA-CR-540) CFSTI: HC $2.00/MF $0.50 CSCL 20K

A theoretical study was conducted on buckling of shallow end closures of cylindrical shells under internal pressure. The most important result from the analysis is that elliptical domes can be designed that do not buckle under internal pressure although they are shallower than the $\sqrt{2}$:1 elliptical domes in common use in aerospace vehicles. This indicates that decreasing the rise of elliptical domes could result in a weight savings because of shortening the structure between tanks and stages of missiles. Finite-deflection theory was used to compute the prebuckling stress distribution. This theory predicts that the rate of change of compressive circumferential stresses as a function of pressure decreases as the internal pressure increases. This nonlinear relationship between hoop stress and pressure results in computed bifurcation pressures for asymmetric wrinkling that are higher than buckling pressures from linear theory and predicts that some closures do not buckle under any pressure. Author

N66-31229*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

APPLICATION OF A DOUBLE LINEAR DAMAGE RULE TO CUMULATIVE FATIGUE

S. S. Manson, J. C. Freche, and C. R. Ensign 1966 47 p refs Presented at the Symp. on Crack Propagation Sponsored by the Am. Soc. for Testing and Materials, Atlantic City, 26 Jun.–1 Jul. 1966

(NASA-TM-X-52226) CFSTI: HC $2.00/MF $0.50 CSCL 20K

The validity of a previously proposed method of predicting cumulative fatigue damage based upon the concept of a double linear damage rule is investigated. This method included simplified formulas for determining the crack initiation and propagation stages, and indicated that each of these stages could be represented by a linear damage rule. Data were obtained in two stress level tests with maraged 300 CVM, and SAE 4130 steels in rotating bending. Two strain level tests were conducted in axial reversed strain cycling with maraged 300 CVM steel. The investigation showed that in most cases the double linear damage rule when used in conjunction with originally proposed equations for determining crack initiation and propagation predicted fatigue life with greater or equal accuracy than the conventional linear damage rule. An alternate viewpoint of the double linear damage rule is suggested which may have value in the prediction of fatigue life under complex loading spectra. Author

N66-31233*# National Aeronautics and Space Administration, Washington, D. C.

STRUCTURAL SYSTEMS AND PROGRAM DECISIONS, VOLUME I

[1966] 437 p refs

(NASA-SP-6008) CFSTI: HC $4.00/MF $2.25 CSCL 20K

A computer weight/performance forecasting procedure which is able to assess design and program changes and to optimize structural systems similar to those of the Saturn V launch vehicle was developed. The procedure is intended to provide management with the information necessary to examine design criteria and philosophy, geometrical constraints, and environmental considerations for their effects on the structural system of a given space vehicle. It is capable of handling the materials normally used in aerospace launch vehicle construction, and the following structural configurations: monocoque, semi-monocoque, 90° waffle, 45° waffle, integral stringer and ring, and honeycomb sandwich construction. In addition, the system will: (1) compare various structural configurations to determine the minimum weight construction for the specific application; (2) compare weights of optimum design structures made from various materials which are acceptable for a specific application; (3) determine the approximate weights of the above; and (4) assess the change in structural weight due to changes in loads and/or design criteria. D.T.

N66-31236# Illinois Univ., Urbana.

FLEXURAL ANALYSIS OF ELASTIC-PLASTIC RECTANGULAR PLATES

L. A. Lopez and A. H.-S. Ang May 1966 131 p refs *Its* Civil Eng. Studies, Structural Res. Ser. No. 305

(Grants NSF GP-984; NSF GK-589)

A numerical technique, based on a lumped parameter model with a finite number of degrees of freedom, was developed for obtaining approximate solutions to elastic–plastic plate problems. The field equations were established and were found to be the finite difference equivalent of equations derived from a continuous plate model with an infinite number of degrees of freedom. The plates under consideration were assumed to be of sandwich construction, with a shear core between two thin sheets; the thin sheet material is elastic–perfectly plastic and its behavior is described by the Prandtl–Reuss stress–strain relation. The core was assumed to be rigid in shear and incapable of developing flexural stresses. Four problems were investigated, including one with both geometrical and material nonlinearities. Due to the lack of formal proofs, the problem of convergence was taken on a heuristic basis. The results show that a sequence of solutions determined with decreasing mesh lengths of the model tend to a unique solution. Furthermore, the validity of these solutions is strongly supported by the upper and lower bound solutions of limit analysis. D.T.

N66-31254# RAND Corp., Santa Monica, Calif.
FURTHER STUDY ON THE DYNAMIC STABILITY OF SHELLS
T. C. Fan May 1966 9 p refs
(P-3352; AD-633138) CFSTI: HC $1.00/MF $0.50

The influence of loading rate on the critical behavior of thin shell responses was investigated. Expressions are presented for radial displacement function in the prebuckling stage and for suddenly applied pressure. The loading rate influence on shell response history is graphed for three different loading rates. It was concluded that the higher rate initiates a larger oscillation earlier. N.E.N.

N66-31277# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
REVIEW OF THE LITERATURE PERTAINING TO THE ANALYSIS OF DEEP BEAMS Final Report
G. E. Albritton Nov. 1965 77 p refs
(TR-1-701; AD-626589) Available from Army Engr. Waterways Expt. Station, Vicksburg, Miss.: HC $1.00; CFSTI: MF $0.75

The objective of this study was to define the state of the art pertaining to the design and analysis of both homogeneous and reinforced concrete deep beams. The study was accomplished by reviewing information found in thirty references, i.e., technical journals and reports. Each of the references is summarized, the important conclusions resulting from the study are presented, and recommendations are made as to needs for additional study. Author (TAB)

N66-31278# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
ENGINEERING TESTS OF T13 PLASTIC AIRPLANE LANDING MAT Final Report
Robert Turner Jun. 1965 51 p ref
(TR-3-677; AD-620041) Available from Army Engr. Waterways Expt. Station, Vicksburg, Miss.: HC $0.50

The report describes results of an investigation conducted to evaluate an experimental, commercially fabricated, plastic landing mat designated the T13. It is a sandwich structure made of glass-fabric-reinforced phenolic resin honeycomb core bonded top and bottom to glass-fabric-reinforced epoxy resin facings. The investigation consisted of laboratory tests to determine the structural properties of the mat and engineering traffic tests to obtain information for use in comparing the performance of the T13 plastic mat with that of the 10-gage M8 steel mat and with project requirements. The tests revealed a major deficiency in the strength of the adhesive bond between the extruded aluminum connectors and the facings of the T13 mat. Other structural properties of the mat, such as tensile, compressive, and flexural strengths of the facings and panels, were close to the desired values considered necessary to meet project requirements. The adhesive bond connection between connectors and facings was supplemented by a riveted type of connection. The T13 mat then sustained 350 coverages of a 50,000-lb single-wheel load and 200-psi tire pressure on a 14-CBR subgrade. Author (TAB)

N66-31285 HITCO, Gardena, Calif.
INVESTIGATION OF CLOSURES AND CLOSURE ATTACHMENTS FOR GRP CYLINDRICAL DEEP SUBMERGENCE VESSELS Final Report, 18 Jan. 1965–15 Apr. 1966
D. Abildskov 15 Apr. 1966 121 p refs
(Contract NObs-92186)
(AD-632821) CFSTI: HC $4.00/MF $0.75

The objectives of the program were to evaluate glass reinforced plastic (GRP) spheres and cylindrical shells with titanium hemispherical closures for deep diving submersible vessels. The design operating depth was 20,000 feet (8889 psi). Filament wound spherical models having a 6 inch ID and cylindrical models having hemispherical end closures 6 inches ID by 20 inches cylindrical shell length were designed, fabricated, and externally hydrostatic pressure tested both statistically and cyclic (fatigue). A total of eight spherical models were evaluated, six of which were tested hydrostatically to failure and two cyclic to failure. The spherical models were fabricated from both S-HTS glass and hollow glass with U. S. polymeric E787 epoxy resin. All spherical models had two titanium reinforced openings. Three cylindrical shell models of sandwich wall construction (S-HTS/E787 faces and hollow glass/E787 core) were evaluated, one was tested hydrostatically to failure and two were subjected to 5000 cycles (one minute dwell at operating pressure) prior to hydrostatic testing to failure. All models were instrumented with strain gages so that analytical and experimental strains could be compared. Author (TAB)

N66-31309# Newmark, Hansen, and Associates, Urbana, Ill.
DESIGN PROCEDURES FOR SHOCK ISOLATION SYSTEMS OF UNDERGROUND PROTECTIVE STRUCTURES. VOLUME V: RESPONSE SPECTRA OF MULTI-DEGREE-OF-FREEDOM ELASTIC SYSTEMS. SUPPLEMENT TO VOLUME V: A COMPUTER PROGRAM FOR THE COMPUTATION OF DYNAMIC STRUCTURAL RESPONSE Technical Report, Nov. 1963–Jan. 1965
N. M. Newmark, W. H. Walker, and R. J. Mosborg Kirtland AFB, N. Mex., AF Weapons Lab., Apr. 1966 79 p Prepared for Gen. Am. Transportation Corp.
(Contract AF 29(601)-6253)
(RTD-TDR-63-3096, Vol. V, Suppl; AD-632805) CFSTI: HC $3.00/MF $0.75

The supplement (to AD-627 516) contains a description of the computer program developed to study the dynamic response of multi-degree-of-freedom systems subjected to earthquake or blast-type ground motions. A description of the features and a derivation of the equations solved by the computer program are presented. The data input to the computer is defined by using a control card containing or preceding each type of input information. The purpose of each control card and the data is given with an example of some typical problems solved using the program. The final section contains the flow diagrams of the main program and each subroutine. Author (TAB)

N66-31331# ARO, Inc., Arnold Air Force Station, Tenn.
AN INVESTIGATION OF THE AEROELASTIC STABILITY OF THIN CYLINDRICAL SHELLS AT TRANSONIC MACH NUMBERS Technical Report, Dec. 27, 1965–Jan. 10, 1966
T. M. Perkins and T. R. Brice Arnold Eng. Develop. Center, May 1966 38 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-93; AD-632829) CFSTI: HC $2.00/MF $0.50

Static pressure and boundary-layer data were obtained over a rigid pressure shell at Mach numbers from 1.20 to 1.50 and Reynolds numbers from 1.04 to 4.20×10^6/ft in the 16-ft transonic tunnel. These data were obtained with and without addition of air into the boundary layer through a circular slot upstream of the test shell. flutter characteristics of thin cylindrical shells were obtained at Mach numbers of 1.20 and 1.50 with and without boundary-layer blowing and shell axial loading. Spirally traveling waves appeared on three of the shells just prior to divergent flutter, which was initiated by reducing shell cavity pressure. Author (TAB)

N66-31354*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HYPERVELOCITY IMPACTS INTO STAINLESS-STEEL TUBES ARMORED WITH REINFORCED BERYLLIUM
A. R. Mc Millan (Gen. Motors Corp., Santa Barbara, Calif.), James A. Diedrich, and Nestor Clough Washington, NASA, Aug. 1966 18 p refs
(NASA-TN-D-3512) CFSTI: HC $1.00/MF $0.50 CSCL 20K

Tubular stainless-steel targets armored with three types of internally reinforced beryllium were impacted with hypervelocity projectiles to determine the cratering behavior and the relative effectiveness of the reinforcements in reducing external cracking damage. The three methods used to internally reinforce the armor were compartmentation, concentric rings of mesh, and randomly oriented, uniformly dispersed filaments. A light-gas gun was used to accelerate 3/32-inch-diameter Pyrex spheres to a nominal impact velocity of 24,000 feet per second. The tubular beryllium targets were maintained at a temperature of 1300°F during impact. Measurements of the craters, descriptions of the total damage, and photographs of the tubes are presented, and comparisons are made with previously reported damage to comparable homogeneous beryllium armored targets. Impacts on the reinforced-armor targets, which were heavier per unit length than the unreinforced-armor targets, showed little reduction in the external cracking damage in the armor compared with the unreinforced-armor targets. Author

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N66-30005# ARO, Inc., Arnold Air Force Station, Tenn.
THERMAL SIMILARITY STUDY OF A TYPICAL SPACE VEHICLE ELEMENT IN A CONDUCTING AND RADIATING MODE
Robert L. Young and Richard V. Shanklin, III Arnold Eng. Develop. Center, May 1966 38 p refs
(Contract AF 40(600)-1200)
(AEDC-TR-66-22; AD-632487) CFSTI: HC $2.00/MF $0.50

Rules of similarity analysis are applied to develop criteria for deducing from model experiments steady-state and transient temperature distributions for a typical space vehicle element exposed to space conditions. The specific purpose is to determine if useful information can be obtained models in space environment chambers. Thermal similarity criteria are deduced from expressions for transient conduction with radiation boundary conditions. Based on three criteria, a prototype and nominally one-half-scale model were designed and tested in a space chamber. To attain thermal similarity, some geometric distortion was necessary in the model. Both prototype and model were thermally cycled. Temperature data for prototype and model are compared at equivalent locations and times. Results show that temperatures agree within an average of approximately 1 percent with a maximum deviation of approximately 5 percent. The model was subsequently altered, thus destroying its thermal similarity. After alteration, the temperature data differed significantly from that of the thermally similar model and prototype. These experimental results demonstrate the correctness of the derived criteria and show close adherence to similarity rules. TAB

N66-30107# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF CONCENTRATION OF AN ALCOHOL–WATER MIXTURE ON CRITICAL DENSITY OF A HEAT FLUX
G. I. Bobrovich and S. S. Kutateladze *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 281–288 refs (See N66-30086 17-23)

Experimental data are reviewed on the typical relationships between the critical heat flux and the concentration of ethyl alcohol–water mixtures at atmospheric pressure. It is pointed out that with a specified concentration of alcohol in the water, foam formation is intense and is characterized by formation of fairly stable films between the vapor bubbles; however, this does not prevent the free progress of the liquid phase between them. It is deduced that the phenomenon is basically associated with mass transfer on the interface of the phases. The various mechanisms are examined, and experimental and calculated values are compared. M.G.J.

N66-30108# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF PULSATION OF SPEED ON ACCURACY OF MEASURING THE TEMPERATURE OF A NONISOTHERMAL TURBULENT FLOW
Yu. L. Rozenshtok *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 289–298 refs (See N66-30086 17-23)

In studying the accuracy of measuring the temperature of a nonisothermal turbulent flow by the contact method, the influence of high speed non-stationariness, which causes a change in heat transfer, is examined. It is shown that in the presence of a correlation between pulsations of the temperature and the speed in the flow, which takes place during the heat transfer, the mean temperature of the thermometer is found to be skewed. An evaluation is given of the magnitude of the systematic error of the thermometer readings with an exponential and power approximation of the cross-correlation function for the pulsation of temperature and speed in the flow. H.S.W.

N66-30109# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINING THE CHAPMAN–JOUGUET PRESSURE AND REACTION TIME IN A DETONATIONAL WAVE OF POWERFUL EXPLOSIVES (VV)
A. N. Dremin and K. K. Shvedov *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 299–314 refs (See N66-30086 17-23)

The pressures in the Chapman–Jouguet plane, and the time of the chemical reaction in the detonation wave of various explosives were measured by an electromagnetic method. The explosives examined were TNT, hexogene, PETN, tetryl, DNT, and mixtures of TNT with hexogenome. The procedures used are described, and it is stated that the width of the zone of the chemical reaction in the detonation wave is approximately five to ten times greater than the width determined by the separation method. H.S.W.

N66-30111# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE MAGNITUDE OF NORMAL SPEED OF FLAME PROPAGATION AND OF LIMITING DIAMETERS DURING THE DISINTEGRATION OF PURE ACETYLENE IN VERTICAL PIPES
B. A. Ivanov and S. M. Kogarko *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 325–330 refs (See N66-30086 17-23)

The magnitude of the normal burning speed of a flame was measured in a pipe that was mounted in a vertical position, and the data were compared to previous results measured in a pipe that was mounted in a horizontal position. Although the absolute values obtained were similar, it was found that in the entire interval of pressures investigated, the values were approximately 2.5 times greater when the pipe was in the vertical position. Since the position of the pipe should not have an effect on the burning rate, it was postulated that the pipes used in previous investigations were insufficiently large in diameter, causing incomplete decomposition of the acetylene. Spectrometric analysis of the decomposition products confirmed this belief. H.S.W.

N66-30112# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

INFLUENCE OF PROPERTIES OF SHELL ON ACTIVATING DETONATION OF LIQUID EXPLOSIVES (VV)

G. V. Dimza *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 331–336 refs (See N66-30086 17-23)

The activation of detonation in a mixture of tetranitromethane and toluene by weak shock waves was investigated by means of transmitting the detonation through water. Detonation actuation increased and the speed of sound in the material of the shell was increased. Author

N66-30113# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ON THE TEMPERATURE FIELD OF A BED WITH THE INJECTION OF A HEAT-TRANSFER AGENT INTO IT

M. A. Pudovkin *In its* J. of Appl. Mech. and Tech. Phys. 14 Sep. 1965 p 337–349 refs (See N66-30086 17-23)

The boundary value problem on determining the field of temperatures in an infinite bed in depth and space is examined. The bed is divided into two parts: into the layer, where the water is pumped in water (water layer), and a sandstone containing petroleum outside the water layer. The bed is assumed thermally anisotropic namely: outside water layer the heat conductivities in the vertical and horizontals are different and are finite; in the water layer the heat conductivity in the vertical direction is infinite and is imperceptibly small in the horizontal direction. The boundary value problem is solved under a specific boundary condition. Author

N66-30118*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

A NEW CONCEPT TO THE GENERAL UNDERSTANDING OF THE EFFECTS OF LONGITUDINAL CONDUCTION FOR MULTISTREAM COUNTERFLOW HEAT EXCHANGERS

C. L. Pan, N. E. Welch, and Robert R. Head 27 Apr. 1966 39 p refs

(NASA-TM-X-53454) CFSTI: HC $2.00/MF $0.50 CSCL 13A

Considerable interest has recently been given to the design of gas flow heat exchangers with large heat transfer areas operating at low flow rates. These design conditions tend to magnify the effect of longitudinal conduction. A new concept is presented in which a plot of a characteristic function is used to obtain a general understanding of the effect of longitudinal conduction for both the two-stream and multistream cases. The function suggests the importance of the diagonal terms in the exact solutions. Therefore, an order of magnitude analysis is made on the basis of this function and the diagonal terms. A new descriptive parameter was derived and the importance of flowrate can be seen. An inefficiency plot was determined from an example analysis of a two-stream symmetric case. Performance equations, correction formula, and quantitative design charts are presented. The effect of large temperature differences on the ends is discussed mathematically. Author

N66-30176*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

ANALYTICAL DETERMINATION OF THE EFFECT OF THERMAL PROPERTY VARIATIONS ON THE PERFORMANCE OF A CHARRING ABLATOR

Claud M. Pittman and William D. Brewer Washington, NASA, Jul. 1966 32 p refs

(NASA-TN-D-3486) CFSTI: HC $2.00/MF $0.50 CSCL 20M

An analytical investigation of the effects of varying certain material properties on the performance of a charring ablator material has been made. The quantities which are varied are char conductivity, conductivity and specific heat of the uncharred material, heat of pyrolysis, temperature of pyrolysis, and the specific heat of the gases of pyrolysis. The effects of these variations on surface recession charred–uncharred interface recession, and internal temperature histories are shown. The analytical results are compared with experimental results and representative material property values are found which provide good agreement. Author

N66-30181*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ATOMIZATION OF ETHANOL JETS IN A COMBUSTOR WITH OSCILLATORY COMBUSTION-GAS FLOW

Robert D. Ingebo Washington, NASA, Jul. 1966 22 p refs

(NASA-TN-D-3513) CFSTI: HC $1.00/MF $0.50 CSCL 21H

Drop-size-distribution data were obtained for jets of ethanol atomized by downstream injection from a simple orifice into a combustion-gas stream inside a rocket combustor. High-frequency acoustic oscillations were induced in the combustor by a siren exhaust system. A high-speed camera was used to obtain photomicrographs of the ethanol sprays at several distances downstream from the injection-tube orifice and over a range of amplitude variations in the acoustic oscillations produced by the siren at a fixed frequency of 1190±5 cps. From the photomicrographs, the volume-number mean drop diameter D_{30} was calculated by direct integration of the drop-size data and compared with values of D_{30} obtained from the Nukiyama–Tanasawa expression for drop-size distribution. The results showed good agreement. Fine atomization was obtained with the siren exhaust system. Also, the atomization process was more rapid with the siren operating. Complete breakup occurred 1 in. downstream from the injector-tube orifice, whereas without the controlled oscillations, 6 in. were required. Similarly, the distance required for relatively complete vaporization was 2 in., whereas, without such oscillation, more than 2 ft were needed. Values of D_{30} determined under "resonant" combustion conditions agreed fairly well with the expression derived for crosscurrent breakup of liquid jets in airstreams. Author

N66-30190# Centre National d'Etudes Spatiales, Bretigny-sur-Orge (France).

THERMAL MEASURE OF THE TOTAL HEMISPHERIC EMISSION OF A WALL [MESURE THERMIQUE DE L'EMITTANCE TOTALE HEMISPHERIQUE D'UN REVETEMENT]

J.-F. Faugere and J.-P. Delpont Apr. 1966 27 p refs in FRENCH

(CNES-NT-4) CFSTI: HC $2.00/MF $0.50

A calorimetric method is presented and an experimental apparatus is described for determining the total hemispherical emittance as a property of the wall. An analysis is given of the conditions and causes of error, and means are discussed for minimizing the error. Finally, the results, are reported for several different wall types and materials used in satellites. Transl. by D.T.

N66-30320# Centre National de la Recherche Scientifique, Paris (France). Laboratoire d'Aerothermique.

ONE-DIMENSIONAL CONGELATION OF A SEMI-INFINITE MEDIUM OF VARIABLE THERMAL PROPERTIES [CONGELATION UNIDIMENSIONNELLE D'UN MILEU SEMI-INFINI A PROPERTIES THERMIQUES VARIABLES]

Jean Bataille and Bernard Le Fur May 1966 33 p refs In FRENCH *Its* Publ.-266
(Rept.-66-2)

In a report on the freezing of soils, an analytical method is presented which is particularly applicable for the determination of the temperature of fusion when the physical properties are constant. Thermal properties are discussed, general equation are given, and the method of resolution is considered. When compared to other methods, the present formulation is found to be easier to use. The method, also shown to be applicable in the case of a one-dimensional semi-infinite medium with variable thermal properties, permits the study of soils with temperatures below freezing. Transl. by M.W.R.

N66-30408# Massachusetts Inst. of Tech., Cambridge. Dept. of Nuclear Engineering.

FRICTION FACTOR AND HEAT TRANSFER CORRELATION FOR IRRADIATED ORGANIC COOLANTS

A. H. Swan and E. A. Mason Sep. 1965 165 p refs
(Contract AT(38-1)-334)
(MIT-334-23) CFSTI: HC $5.00/MF $1.00

Heat transfer and friction factor data were taken on Santowax WR over the Reynolds number range of $10^4 < Re < 10^5$ and it was found to fit the usual correlations, within an uncertainty of ±10%. A comparison was made of other data by others to try and resolve why some of the data show a Reynolds number exponent greater than 0.8. The Dittus–Boelter type equation $Nu_B = 0.023\ Re_B^{0.8} Pr_B^{0.4}$ or a Colburn-type equation $j^* \equiv St\ Pr_B^{0.6} = 0.023\ Re_B^{-0.2} = f/8$ is recommended to calculate heat transfer factors or friction factors for irradiated organic coolants. Author (NSA)

N66-30442# Library of Congress, Washington, D. C. Aerospace Technology Div.

DETERMINING THE TEMPERATURE FIELD OF TURBINE BLADES WITH LONGITUDINAL AIR COOLING ON THE BASIS OF ASYMPTOTIC METHODS OF ANALYSIS [OPREDELENIYE TEMPERATURNOGO POLYA TURBINNIKH LOPATOK S PRODOL'NYM VOZDUSHNYM OKLAZHDENIYEM NA OSNOVE ASIMPTOTICHESKIKH METODOV ANALIZA] Surveys of Foreign Scientific and Technical Literature

I. S. Lyubchenko 11 May 1966 20 p refs Transl. into ENGLISH from Izv. Vysshikh Uchebn. Zavedenii, Aviats. Tekh. (Kazan), no. 3, 1965 p 98–107
(ATD-66-51)

Asymptotic analysis was used to obtain an approximate solution for the temperature field of air cooled gas turbine rotor blades, in order to determine the thermal stress. The solution is given for the most general case, in which the error of the actual relationships of the quantities entering into the system does not exceed 3%. D.T.

N66-30500# Weapons Research Establishment, Salisbury (Australia).

SOME APPROXIMATE SOLUTIONS FOR HEAT CONDUCTION IN WALLS HEATED CONVECTIVELY

G. Jepps Apr. 1966 32 p refs
(WRE-HSA-21) CFSTI: HC $2.00/MF $0.50

The general theory of one-dimensional heat conduction is applied to single-layer walls subjected to aerodynamic heating, with the heat transfer coefficient h and the adiabatic wall temperature T_{aw} functions of time. Approximations are discussed for thick and thin walls, corresponding to the time being small or large. The small time approximations are deduced from existing solutions, and expressions for their errors are derived. It is shown that the heated surface temperature of a wall of finite thickness behaves like that of a semi-infinite wall if the non-dimensional time τ is less than $1/\pi$. Simple analytic expressions are given for the case of constant h and T_{aw}. A large time approximation is derived for $\tau > 1/\pi$. Although this approximation is only an extension of simple thin wall theory, it has many applications. The temperature distribution across the wall is represented by a quartic in distance. When h and T_{aw} are constant, the analytic form of the approximation is similar to that of simple thin wall theory. The extended thin wall theory is valid for any value of the heat transfer parameter $\frac{hl}{K}$. Author

N66-30546# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

THE EFFECT OF A TRANSVERSE NOTCH ON THE HEAT TRANSFER RATE FROM A HEATED VERTICAL PLATE IN FREE CONVECTION

Carl Clifford Fletcher, Jr. (M.S. Thesis) Mar. 1966 77 p refs
(GAM/ME/66A-2; AD-632397) CFSTI: HC $3.00/MF $0.75

Based on the results of this study, the following conclusions are drawn: (1) The notch effect on heat transfer is local in nature with the range of influence restricted to a region from about one inch below the notch to about two inches above the notch. (2) The net notch effect is to increase the heat transfer; the maximum increase obtained was 8.6% over the region influenced by the notch, whereas the minimum increase was 3.1%. Heat transfer in the notch interior is reduced; however, heat transfer exterior to the notch is increased and is dominant. (3) For notch depths between 0.2 and 1.0 inch, the heat transfer rate is independent of notch depth. (4) Heat transfer increase is a function of notch elevation; it decreases with elevation up to the point at which the flow normally begins the transition to a turbulent flow and increases beyond this point. (5) The flow pattern about the notch centerline is unsymmetrical. Author (TAB)

N66-30606*# Martin Co., Denver, Colo.

SOLID-PROPELLANT ROCKET EXHAUST EFFECTS (SPREE) AND METHODS OF ATTENUATION, VOLUME I: PROJECT SUMMARY

E. A. Darrow and E. Lays Jan. 1966 40 p
(Contract NAS10-2300)
(NASA-CR-76236; CR-65-93, Vol. I) CFSTI: HC $2.00/MF $0.50 CSCL 21B

Results and conclusions are presented for a program dealing with solid propellant rocket exhaust effects (SPREE) and methods of attenuation. Organization of the program and test configurations are given, along with recommendations for further studies. Attention is given to the prediction models, scale-model test, protective materials, deflectors, and umbilical tower and other support equipment. Effects of motor characteristics are discussed, and primary effects parameters are

developed. Discussed are the effects of propellant aluminum content, motor chamber pressure, and liftoff acceleration; as well as exhaust plume characteristics and umbilical tower pressures and temperatures. M.W.R.

N66-30607*# Martin Co., Denver, Colo.
SOLID PROPELLANT ROCKET EXHAUST EFFECTS (SPREE) AND METHODS OF ATTENUATION, VOLUME II, PART II, PHASE II Final Report
E. Lays and E. A. Darrow Jan. 1966 192 p refs
(Contract NAS10-2300)
(NASA-CR-76235; CR-65-93, Vol. II) CFSTI: HC $5.00/MF $1.25 CSCL 21B

Materials are evaluated, the test facility is described, and solid rocket motor design and performance is reported for the solid propellant rocket exhaust effects (SPREE) program aimed at providing data for use in protecting launch facilities from potentially damaging effects of the rocket exhaust plume. Consideration is given to the characteristics of the motor exhaust plume as well as to multiple motor effects on deflectors, aluminum content and scale effects, and liftoff acceleration effects. Protective coatings for ground support equipment are discussed. The reported SPREE data were made on scale models of launch operation equipment, with only a limited amount of full-scale firing data available. M.W.R.

N66-30687# Naval Ordnance Lab., White Oak, Md.
CALCULATED THERMODYNAMIC PROPERTIES OF REAL HYDROGEN UP TO 30,000 ATMOSPHERES AND 3500°K
David N. Bixler, Robert Piacesi, and Arnold E. Seigel 1 Dec. 1965 31 p refs
(Ballistics Res. Rept.-153; NOLTR-65-209; AD-633142) CFSTI: HC $1.00/MF $0.50

Isentropic data for real hydrogen are calculated in a range of pressures up to 30,000 atmospheres and temperatures up to 3500°K. The effects of ionization, excitation, and dissociation are considered negligible because of the relatively low temperatures and high densities involved. The effects of the intermolecular force are accounted for by fitting a virial coefficient equation to low temperature high density experimental data. These calculated data in turn are fitted to an empirical entropic equation of state. This particular equation of state is convenient for describing many thermodynamic processes. TAB

N66-30691# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
SMALL-AMPLITUDE COMBUSTION PRESSURE OSCILLATIONS IN THE GAS ROCKET
Philip J. Goede Jun. 1966 74 p refs
(Contracts AF-AFOSR-753-65; AF-AFOSR-753-66)
(TM-66-4; JPC-420; AD-633308) CFSTI: HC $3.00/MF $0.75

The problem of small-amplitude, high-frequency, longitudinal combustion pressure oscillations in a rocket motor burning premixed gaseous propellants is the object of study of the analysis. Combustion zone chemical kinetics is found to be the driving mechanism of the phenomenon. A linearized, small-perturbation analysis is used to investigate the propagation of non-isentropic waves through the non-adiabatic flame zone. Effects of steady state chamber operating parameters on the amplification of oscillations are then presented with comparison to experimental trends. For example, in the equivalence ratio–chamber length stability plot a certain degree of correlation is noted. Author (TAB)

N66-30780# Rhodes and Bloxsom, Canoga Park, Calif.
HEAT TRANSFER AND FLOW VISUALIZATION ON 1/2 INCH DIAMETER CYLINDERS IN LAMINAR HYPERSONIC FLOW
Albuquerque, N. Mex., Sandia Corp., Jan. 1966 56 p Prepared for Sandia Corp.
(Contract AT(29-1)-789)
(SC-DC-65-1907) CFSTI: HC $3.00/MF $0.50

Aeroheating rates were measured on cylinders with length-to-diameter ratios of 1, 4, 5, 8, and 15 and ratios of corner radii to cylinder radii of 0, 0.2, 0.4, 0.6, 0.8, and 1.0. Angles of attack ranged from 0 to 90°. The test facility was the Rhodes and Bloxsom 60-inch hot-shot tunnel. Shock wave locations were also obtained from luminosity photographs. Tunnel conditions resulted in hypersonic laminar continuum flow with negligible radiant heating. Author NSA

N66-30837# Iowa State Univ. of Science and Technology, Ames.
APPLICATION OF GIBBS–DUHEM EQUATION TO BINARY VAPOR-LIQUID EQUILIBRIUM DATA OF METAL SYSTEMS USING NEWTON'S INTERPOLATION FORMULAE
V. E. Sater and F. D. Stevenson Aug. 1965 33 p refs
(Contract W-7405-ENG-82)
(IS-1241) CFSTI: HC $2.00/MF $0.50

Integration of the Gibbs–Duhem equation using Newton's interpolation formulas was programmed in Fortran for both smoothed and unsmoothed activity coefficient data of binary systems, giving values of the second activity coefficient as a function of concentration. The conventional area test was also programmed to test the thermodynamic consistency when both activity coefficients have been independently determined. The Gibbs–Duhem equation is additionally used with numerically differentiated values of the log activity coefficient-concentration curves to indicate local consistency of the data. The programs and examples of their application are included. Author (NSA)

N66-30856*# Purdue Univ., Lafayette, Ind. Jet Propulsion Center.
TRANSPIRATION COOLING—ITS THEORY AND APPLICATION
J. B. Kelley and M. R. L'Ecuyer Jun. 1966 180 p refs
(Grant NsG-592)
(NASA-CR-76367; TM-66-5; JPC-422) CFSTI: HC $5.00/MF $1.00 CSCL 20M

A literature review was conducted of the various theories proposed and the experimental results obtained in the field of transpiration cooling of turbulent boundary layers. The more prominent and applicable theories for the turbulent boundary layer with distributed injection are described and compared with the pertinent experimental data. Emphasis is placed on the physical processes involved in reducing heat transfer and skin friction due to transpiration from a porous surface. Theoretical and empirical solutions which enable the most accurate predictions of mass injection rates for a specified surface temperature are recommended and sample calculations are presented to illustrate a typical application. Experimental investigations are discussed to establish the effect of various independent parameters on the skin friction coefficient and heat transfer rate. A correlation procedure based on the data is shown to agree with the analyses, considering problems due to experimental error. A solution for the prediction of mass flow rates through porous materials is recommended and deviation causes from these predictions are described qualitatively. Various porous materials are discussed and compared on the basis of the most desirable properties. R.N.A.

N66-31000# California Univ., Berkeley. Lawrence Radiation Lab.
THE HEAT CAPACITY OF LIQUID METALS
Thomas W. Chapman 15 Feb. 1965 19 p refs
(Contract W-7405-ENG-48)
(UCRL-11931) CFSTI: HC $1.00/MF $0.50

The theory of the radial distribution function was used to establish a corresponding states correlation of the configurational heat capacities of six low-melting metals. It is suggested that this correlation may be used to estimate the configurational contribution to the specific heats of other liquid metals. The theory was also used to explain the observed temperature dependence of liquid metal heat capacities. NSA

N66-31101# Office of Naval Intelligence, Washington, D. C. Translations Section.
ELECTROMAGNETIC RADIATION PRODUCED IN THE DETONATION OF INDUSTRIAL EXPLOSIVES [ELEKTROMAGNITNOYE IZLUCHENIYE PRI VZRYVE PROMYSHLENNYKH VV]
V. N. Zenin and V. N. Mits [1963] 58 p refs Transl. into ENGLISH from Vzryvnoe D'elo (Moscow), v. 9, no. 52, 1963 p 115-129
(ONI-TRANS-2064-a; AD-627254) CFSTI: HC $3.00/MF $0.50

The results of an investigation of the pulses of electromagnetic radiation arising from the detonation of the most characteristic industrial explosives indicate the following facts: (1) the emission of electromagnetic energy is connected essentially with the expansion of gaseous products of the detonation; (2) each explosive has a characteristic electromagnetic pulse, reproducible in parallel experiments; and (3) for different explosives these pulses differ markedly one from another. TAB

N66-31140# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SPECTROSCOPIC INVESTIGATION OF THE STATE OF GAS BEHIND A DETONATION FRONT
R. I. Soloukhin and T. A. Sharapova 13 May 1965 11 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i. Techn. Fiz. (Moscow), no. 2, 1962 p 37-41
(FTD-TT-65-33/1+2; AD-615984) CFSTI: HC $1.00/MF $0.50

Data are presented on distribution of illumination and gas temperature behind a detonation front in acetylene-oxygen mixtures. The existence was noted of a nonequilibrium concentration of C_2 in the narrow zone, adjoining the wave front. Gas temperatures were measured by a general method of turning spectral lines. TAB

N66-31147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH TEMPERATURE HEAT-TRANSFER AGENTS
A. V. Chechetkin 9 Apr. 1965 438 p refs Transl. into ENGLISH of the book "Vysokotemperaturnyye Teplonositeli" Moscow, Gos. Energ. Izd., 1962 p 1-427
(FTD-MT-63-246; TT-65-62982; AD-619382)

The properties of high-temperature heat-transfer agents are described, the necessary data for thermal and aerohydrodynamic calculations of processes of heating and cooling with the help of these heat-transfer agents are given; diagrams of heating installations and information on their arrangement and operation are given, and the areas of possible application of each high-temperature heat-transfer agent are shown. Author (TAB)

N66-31238# Wisconsin Univ., Madison.
THE EFFECT OF SELECTED FLUID PARAMETERS ON SPATIAL DROP SIZE DISTRIBUTION
Edward Junior Rice (Ph.D. Thesis) 1966 290 p refs

A fluorescent technique for studying microscopic properties of a fluid is described, along with the apparatus, its alignment and calibration. Extremely fine spatial resolution is obtained by using a high intensity sheet of radiation intersecting the spray at 75° and having a uniform thickness of 0.2 mm. Droplets of the fluid, containing fluorescent dye, absorb radiation from the radiation sheet. The high resolution camera has a 25 magnification and resolves a 10 micron drop with less than 10% error. A modified spot counter is used to size the photographed drops. Data is presented at six adjacent radial positions for ethanol at 40, 70, and 100 psig; 50% glycerol-50% water at 130, 170, and 210 psig; and 65% glycerol-35% water at 170, 210, and 250 psig. It was found that the maximum drop size could be used to describe the drop size distribution. The maximum drop size was correlated with the fluid properties, nozzle pressure, and position in the spray. N.E.N.

N66-31243# Technische Hogeschool, Delft (Netherlands). Laboratorium voor Verbrandingsmotorey en Gasturbines.
AIRCOOLING OF GAS TURBINE COMBUSTION CHAMBERS
V. A. Ogale and F. L. Dooper Jan. 1966 43 p refs
(Rept.-10.M.004) CFSTI: HC $2.00/MF $0.50

This report presents a literature survey of air cooling of the flametubes of gas turbine combustion chambers. Each of the different methods of wall cooling is discussed separately. It is shown that effusion cooling is thermodynamically by far the most effective method, while the use of "louvred" surfaces represents the nearest practical approach to this ideal which is possible. Refractory linings are very useful for gas turbine systems burning residual oil blends, while ceramic coatings have a short life due to their poor resistance to thermal shocks. Convective air flow cooling and localised air flow cooling, or a combination of these are not very efficient, but are suitable for simple gas turbine combustion systems and aircraft combustors. Finally, it is found that the flame tube wall temperature increases with increase in pressure, inlet temperature and flametube size, and decreases with increase in massflow. Author

N66-31267# Stanford Research Inst., Menlo Park, Calif.
IGNITION OF SIMULATED PROPELLANTS BASED ON AMMONIUM PERCHLORATE
W. A. Rosser, N. Fishman, and H. Wise 30 Jul. 1965 35 p refs
(Contract Nonr-3415(00))
(PU-3573; AD-619067) CFSTI: HC $2.00/MF $0.50

The ignitability of simulated solid propellants based on NH_4ClO_4 was studied using the radiation from an arc image furnace as a source of ignition energy. The experimental measurements provide (for given conditions) the minimum time of exposure to radiation required for ignition and combustion of pellets pressed from powdered mixtures of NH_4ClO_4 and copper chromite; NH_4ClO_4 carbon, and copper chromite; and NH_4ClO_4 copper chromite, and polyethylene. Minimum exposure times were determined as a function of pellet composition, flux (20 to 120 cal/cm^{2}sec), pressure (1 to 40 atm), and composition of the atmosphere (N_2, He, A) in contact with the pellet. The experimental results in conjunction with supplementary kinetic information indicate that, for these materials, gas phase ignition need not be preceded by a catastrophic rate

of heat release within the sample. The critical chemical species involved during gas phase ignition is probably perchloric acid. Under some circumstances, a high rate of solid reaction does appear to be involved during ignition of the materials. Author (TAB)

N66-31288# Mithras, Inc., Cambridge, Mass.
FLUCTUATING INFRARED RADIATION FROM HOT JETS, BOUNDARY LAYERS AND SHEAR LAYERS Final Report, 1 Oct. 1964–30 Sep. 1965
James Stark Draper Mar. 1966 126 p refs
(Contract Nonr-3489(00))
(MC-61-5-R6; AD-632694) CFSTI: HC $4.00/MF $0.75

Four aspects of the near field infrared background noise problem have been investigated: (1) a semi-empirical theory for predicting the levels and spectral distribution of infrared radiation fluctuations from an optically thin hot turbulent flow has been developed, (2) an experimental program has been completed and has confirmed the theory developed by comparing predictions of the broad band rms radiation and spectral radiation with radiometric measurements, (3) a series of flight-regime charts have been derived that show the spectral distribution of the near field radiation, and (4) the dependence of the background noise upon the system optical field has been derived. Author (TAB)

N66-31297# Arizona State Univ., Tempe.
THE EXPERIMENTAL DETERMINATION OF BURNING VELOCITIES FOR STOICHIOMETRIC CARBON MONOXIDE-OXYGEN MIXTURES IN A RIGID SPHERICAL BOMB AND ITS DEPENDENCE ON TEMPERATURE, PRESSURE, AND MOISTURE CONTENT
James Willard Zeberlein (M.S. Thesis) May 1966 107 p refs
(Contract AF 33(608)-1204)
(AD-633192) CFSTI: HC $4.00/MF $0.75

The results of the constant volume spherical bomb method of studying the burning velocity for stoichiometric water catalyzed $CO–O_2$ mixtures are given. Judging the results of the calculated and observed values of burning velocity and taking into account experimental error, the self-consistency of this method of obtaining velocities is verified. The burning velocity increases linearly with increasing temperature and this effect is more predominant at higher pressures. Burning velocity is affected little by pressure at room temperature; but at increased temperatures, it increases nearly linearly with pressure. Temperature has a greater effect on burning velocity than does pressure, burning velocity increases nonlinearly at a rapid rate with increasing moisture content up to 2.25%. Thereafter, it increases linearly at a less rapid rate. Author (TAB)

N66-31361*# Princeton Univ., N. J. Guggenheim Labs. for the Aerospace Propulsion Sciences.
A STUDY OF INJECTOR SPRAY CHARACTERISTICS IN A SIMULATED ROCKET COMBUSTION CHAMBER INCLUDING LONGITUDINAL MODE PRESSURE OSCILLATIONS Technical Report No. 730
Dennis A. Gary Jun. 1966 74 p refs
(Contract NASr-217)
(NASA-CR-76372) CFSTI: HC $3.00/MF $0.75 CSCL 21B

Number size droplet counts were obtained from various 90° impinging jet injectors in ambient pressure drops across the injectors of up to 100 psia. They were conducted in constant ambient and oscillating pressures with peak to peak values which were 5% of the mean ambient pressure. The distributions were compared by representative curves fitted to the data. In developing the curve fitting technology, several different equations were suggested and used to represent the data. These curves serve as an analytical representation of the spray characteristics, relieve the problems associated with data scatter, and provide, from the associated constants, an improved physical model of distribution variations. A complete review of these equations and the methods of fitting them to the data is included. An evaluation of the success of the representation of a real point distribution by each of the representative curve distributions is presented. R.N.A.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N66-30121*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PUBLICATIONS OF THE JET PROPULSION LABORATORY, JULY 1961 THROUGH JUNE 1962
S. L. Kresser and R. J. Sippel 15 Oct. 1962 84 p refs
(Contract NAS7-100)
(NASA-CR-76111; JPL-BIBL-39-3) CFSTI: HC $3.00/MF $0.75 CSCL 22A

Abstracts, open literature searches, and translations are included in this annotated bibliography covering the following topics: space vehicles, propulsion and communications systems, gas dynamics, electronic equipment, and chemical engineering. Other topics listed are: radiation studies, spacecraft instrumentation and equipment, biological investigation, celestial mechanics, computer programming, environmental simulation, thermodynamics, meteorology, integral equations, fabrication and structural materials, lunar research, radiation studies, and reliability and quality control. R.U.

N66-30151# General Motors Corp., Indianapolis, Ind. Allison Div.
ALLISON RESEARCH AND ENGINEERING, VOLUME NO. 10, SECOND QUARTER 1966
[1966] 43 p refs

CONTENTS:

1. THE THEORY OF MAGNETO-FLUID-DYNAMICS William R. Sears (Cornell Univ.) p 1

2. NONEQUILIBRIUM IONIZATION FOR MPD POWER GENERATION D. L. Tipton and T. L. Rosebrock p 2–19 refs (See N66-30152 17-25)

3. LABORATORY TESTS FOR EVALUATION OF SURFACE DETERIORATION IN GAS TURBINE ENGINE MATERIALS G. R. Sippel and J. R. Kildsig p 20–35 refs (See N66-30153 17-15)

N66-30254*# Documentation, Inc., College Park, Md.
IMPROVING ANNOUNCEMENT MEDIA FOR TECHNICAL REPORTS
Douglas S. Price May 1966 26 p
(Contract NASw-1315)
(NASA-CR-62031) CFSTI: HC $2.00/MF $0.50 CSCL 05B

Experiments and techniques utilized in the NASA Scientific and Technical Information Facility to solve problems

associated with producing camera-ready copy of abstract journals and their indexes are described. The journal principally discussed is Scientific and Technical Aerospace Reports (STAR). Since the entries in the abstract section of the journals are published only once and are not subsequently manipulated, a photocomposition system was selected to produce this section to the highest graphic standards. Index requirements involving multiple entries and cumulations initially dictated computer printout for the production of the index section. The production of indexes evolved from the original upper case chain, through a 120-character, upper-and-lower case chain to the present system of preparing indexes on the 300-character-per-second GRACE (graphic arts composing equipment) photocomposition device. The productivity of the Facility's original photocomposition equipment used for preparing the abstract portion of STAR was improved by the addition of a paper-tape reader and multiple off-line keyboards. The recent installation of a Photon 713 offers 3 to 5 times faster composition speeds and the capability of operating either from paper tape or magnetic tape prepared by the computer. This new capacity opens up many possibilities for improving efficiency and adding new services. Author

N66-30288# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HERALD OF THE ACADEMY OF SCIENCES OF THE USSR Selected Articles

4 Aug. 1965 14 p Transl. into ENGLISH from Vestn. Akad. Nauk SSR (Moscow), no. 9, 1964 p 71–74; 114–115 (FTD-65-612/1+2+3+4; TT-65-63082; AD-619451) CFSTI: HC $1.00/MF $0.50

CONTENTS:

1. SYNTHESIS OF NEW FIBERFORMING POLYMERS M. M. Koton p 1–7 (See N66-30287 17-18)
2. THEORY OF MOTION OF ARTIFICAL EARTH SATELLITES Y. V. Batrakov p 8–10 (See N66-30288 17-30)

N66-30323# Joint Publications Research Service, Washington, D. C.

CYBERNETICS AIDS ANALYSIS OF THE PRODUCTION PLANNING PROCESS IN THE EAST GERMAN MACHINE-BUILDING INDUSTRY

J. Winkelmann 6 Jul. 1966 19 p Transl. into ENGLISH from Fertigungstech. und Betrieb (Berlin), no. 5, May 1966 p 278–282 (JPRS-35321; TT-66-32753) CFSTI: $1.00

Long-range and operational planning are considered in terms of tasks and time requirements that can be aided by introducing the methods of cybernetics and mathematical analysis. While it is pointed out that there is at present no useful cybernetic model for the structure and behavior of management processes, attention is given to a control loop and a simple block diagram for making up a balance which employs the techniques of cybernetics. A typical process of production planning is analyzed and illustrated. M.W.R.

N66-30375*# Westinghouse Electric Corp., Pittsburgh, Pa.

TECHNOLOGY UTILIZATION—THE INDUSTRIAL OPPORTUNITY

S. W. Herwald *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 72–77 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The widespread effect of the current space research program on industry and the general economy is discussed, and the impact of space surveillance on various land and resource applications is tabulated. Possibilities for observing agricultural features from space are outlined as feasible, probable, and questionable activities. These range from contour farming and terracing requirements, considered feasible, to observations of water vapor over vegetation, considered questionable. Use of present resources as well as environments which are presently unsuitable for agriculture are discussed. It is pointed out that only 3.2 of the 126 billion acres on the earth are suitable for agricultural purposes; and it is speculated that raising the temperature in areas such as the Arctic would aid in capturing some of the mineral resources, providing additional water resources, and developing additional agricultural areas. Utilizing energy from the sun through boosters in orbit can theoretically perform such a function. A satellite system to provide navigation and traffic control information is considered possible in the immediate future. M.W.R.

N66-30376*# Indiana Univ., Bloomington.

INNOVATION, ORGANIZATION, AND TECHNOLOGY TRANSFER

Arthur M. Weimer *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 78–81 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The dissemination of space science and technology research findings to private business firms is discussed; and the cooperative efforts of government, industry, and the academic worlds are stressed. It is noted that top management in industry is particularly interested in smooth technology transfer and that abstracts in ready-to-use form are extremely important in effecting this transfer. Operations and experiences at the Aerospace Research Applications Center at Indiana University are discussed. M.W.R.

N66-30377*# Pennsylvania Univ., Philadelphia. Dept. of Regional Science.

THE IMPACT OF SPACE RESEARCH EXPENDITURES ON URBAN AND REGIONAL DEVELOPMENT

Walter Isard and Stanislaw Czamanski *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 82–89 refs (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

Economic-base models, econometric-multiplier models, and regional input–output techniques are considered for the determination of the impact of space-research activities on urban and regional development. Difficulties inherent in the economic-base approach are outlined, and a econometric model is described which postulates that economic development and population change are interdependent and ought to be statistically explained simultaneously. Geographically-oriented, complementary, and urban-oriented industries are discussed in terms of industrial location theory; and a general model is constructed which is highly aggregative, employs population and employment categories as indexes, and assumes that characteristic differences between cities of the same size class are negligible. Even this model does not detect economic interdependences, and so the input–output technique is discussed as an approach which incorporates inter-industry relations. Results for California as a whole, Los Angeles, San Francisco, St. Louis, and Kalamazoo were adapted for comparison by economic-base, average and marginal econometric multipliers, and input–output techniques. M.W.R.

N66-30381*# Massachusetts Inst. of Tech., Cambridge.
THE SPACE PROGRAM AND HIGHER EDUCATION
James R. Killian, Jr. *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 115–118 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The widespread involvement of higher education in the space program is applauded, and it is noted that space-related research is carried out not only in the physical and biological sciences and in engineering, but also in the social and behavioral sciences, humanities, and management and law. A brief review is given of NASA's sustaining university program which began in 1962; and it is noted that 52 students have already completed their PhD's through NASA support and that 80% of the first group of 886 students to enter the predoctoral program have received their degrees or are still in training. In addition, 27 universities have received grants totaling more than $29,000,000 over a four-year period for construction of new research laboratories. There is also an interdisciplinary grant program through which 31 universities have received grants of between $50,000 and $1,000,000 annually, for a total of more than $7,000,000 each year. NASA has supported, or is currently supporting, studies aimed at promoting more rapid, widespread industrial applications of new knowledge developed in the space program. Mention is made of projects underway at some of the midwestern universities. M.W.R.

N66-30382*#
THE POLITICS OF OUTER SPACE
Harlan Cleveland *In* NASA, Washington Proc. of the 5th Natl. Conf. on the Peaceful Uses of Space 1966 p 129–133 (See N66-30366 17-30) GPO: HC $1.50; CFSTI: MF $1.25

The political implications of outer space research and international cooperation on findings is stressed. It is pointed out that three conditions must be fulfilled before nations can agree to work together, even if they continue to argue about why they are working together. The technology to make cooperation necessary must be available, national leaders who understand the implications of international efforts must feel the need to cooperate, and there must be international institutions to reflect common interests. Recent development in weather reporting for forecasting represents a good case in point; and the agreements that will make a world system of the world's weather envelope are an illustration of international cooperation that set an example. The emergence of limited-purpose international organizations which bypass the obstacles posed by sovereignty and which aid in world peacekeeping are discussed. M.W.R.

N66-30520# RAND Corp., Santa Monica, Calif.
SOME ASPECTS OF THE ALLOCATION OF SCIENTIFIC EFFORT BETWEEN TEACHING AND RESEARCH
Michael D. Intriligator and Bruce L. R. Smith Mar. 1966 28 p refs
(Contract AF 49(638)-1700; Proj. RAND)
(RM-4339-PR; AD-632155) CFSTI: HC $2.60/MF $0.50

The study considers some aspects of the allocation of scientific effort by means of an analytic framework consisting of specified policy objectives and a model for the allocation of new Ph.D.s in science between teaching and research. Some simplifying assumptions lead to a general welfare function for this aspect of a national science policy. The production of new scientists is determined in the model by a production function, dependent on teaching scientists and on time. For any of the special cases of the welfare function and for a production function with a constant ratio of new scientists to teaching scientists, an initial allocation of a maximum proportion of new scientists to teaching is preferred, followed by a switch to a minimum proportion of new scientists to teaching. Similar 'switching' solutions also apply to a wider class of objectives and production functions. The analytic framework and preferred allocations are briefly examined with respect to 'real world' considerations and to their possible implications for national policy. Several policy initiatives are discussed in light of the model and some possible changes are suggested in government policies on R and D support and aid to science education. Author (TAB)

N66-30594*# Midwest Research Inst., Kansas City, Mo.
TECHNIQUES FOR ESTIMATING COUNTY INCOME IN A SIX-STATE AREA Methodological Summary Report, 1950-1962
1 Jun. 1966 48 p refs
(Contract NASr-63(04); MRI Proj. 2571-M)
(NASA-CR-76250) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This study was conducted to stimulate the development of estimates of county income, population, and other measures of economic progress for use in assessing and measuring the economic impact of NASA programs in a six state region (Oklahoma, Arkansas, Iowa, Missouri, and Nebraska). This report describes the methodology used by the six state study teams to estimate personal income for the years 1950-1962. Included are discussions on problems of regional analysis, personal income as a measure of economic growth, alternative procedures for estimating county income, and procedures used by the six states in estimating wage and salary income, other labor income, property income, proprietors' income, transfer payments, and personal contributions for social insurance. R.N.A.

N66-30597*# Midwest Research Inst., Kansas City, Mo.
PERSONAL INCOME AND POPULATION IN KANSAS COUNTIES: 1950–1962
1 Jun. 1966 40 p refs Appendix to NASA-CR-76250
(Contract NASr-63(04); MRI Proj. 2571-M)
(NASA-CR-76204) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This study was conducted to develop a reliable series of data on annual personal income and population for 105 counties in the state of Kansas for the period 1950 through 1962. A methodology was developed which can be used to update these estimates each year. The procedures used are outlined and the population and personal income estimates for the counties are tabulated. R.N.A.

N66-30598*# Midwest Research Inst., Kansas City, Mo.
PERSONAL INCOME AND POPULATION IN OKLAHOMA COUNTIES: 1950–1962
1 Jun. 1966 40 p refs Appendix to NASA-CR-76250
(Contract NASr-63(04); MRI Proj. 2571-M)
(NASA-CR-76203) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This report presents a detailed discussion on the sources of data and the methodology used to derive annual population and personal income data for the 77 counties in the state of Oklahoma for the period 1950 through 1962. Tabulated estimates of population and personal income are presented by county. R.N.A.

N66-30603*# Midwest Research Inst., Kansas City, Mo.
PERSONAL INCOME AND POPULATION IN ARKANSAS COUNTIES: 1950–1962
1 Jun. 1966 39 p refs Appendix to NASA-CR-76250
(Contract NASr-63(04); MRI Proj. 2571-M)
(NASA-CR-76206) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This study was carried out to develop reliable data on the annual population and personal income of the 75 counties of the state of Arkansas for the period 1950 through 1962. The strengths and limitations of the income sources are discussed along with the methodology used for estimating county wage and salary disbursements, other labor income, proprietors' income, property income, transfer payments, and personal contributions for social insurance. Tabulated estimates of population and personal income are presented by county. R.N.A.

N66-30604*# Midwest Research Inst., Kansas City, Mo.
PERSONAL INCOME AND POPULATION IN NEBRASKA COUNTIES: 1950–1962
1 Jun. 1966 42 p refs Appendix to NASA-CR-76250
(Contract NASr-63(04); MRI Proj. 2571-m)
(NASA-CR-76207) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This study was conducted to develop a reliable series of data on annual population and personal income for the 93 counties in the state of Nebraska for the period 1950 through 1962. A methodology was developed for a rapid and accurate updating of future county personal income estimates. The personal income concepts and methods used to derive the estimates are discussed. Tabulated estimates of personal income and population are presented by county. R.N.A.

N66-30754*# State Univ. of Iowa, Iowa City. Bureau of Business and Economic Research.
PERSONAL INCOME AND POPULATION IN IOWA COUNTIES: 1950–1962
Kansas City, Mo., Midwest Res. Inst., 1 Jun. 1966 50 p refs Prepared for Midwest Res. Inst. Appendix to NASA-CR 76250
(Contract NASr-63(04); MRI Proj. 2571-M)
(NASA-CR-76303; MRI-2571-M) CFSTI: HC $2.00/MF $0.50 CSCL 05C

Methods used in making allocations of state personal income to the 99 counties in Iowa for the years 1950–1962 are discussed; and results are tabulated. Allocation methods were determined through such techniques as correlation analyses among data sources, mappings, rank correlations, and trial-and-error procedures. Estimates of total personal income by county were obtained by allocating the following categories of state personal income to the counties: wage and salary disbursements, including farms, mining, contract construction, manufacturing, wholesale and retail trade, finance, insurance, real estate, transportation, communications, public utilities, services, government, and other industries; other labor income; proprietors' income; property income; transfer payments; and personal contributions to social insurance. Tabulated estimates of population and personal income by county are presented. Procedures for estimating farm income are outlined, and data sources are included. S.P.

N66-30756*# George Washington Univ., Washington, D. C.
MAJOR FACTORS IN AEROSPACE PLANNING AND DECISION
Robert G. Smith 10 May 1966 184 p refs
(Grant NsG-727)
(NASA-CR-76298) CFSTI: HC $5.00/MF $1.25 CSCL 05A

An analysis of economic, technical, and socio-political factors considered by aerospace industry managers in their long range planning and decision making functions was conducted, to focus attention on the interdisciplinary aspects of the space-age planning process. Personal contact was made with managers of various government agencies and aerospace companies to determine management's role in decision making, and it was concluded that there was no universally acceptable planning format for all companies in all situations. It is intended that this analysis offer general insight into the challenges and problems facing aerospace industry managers. The impact on the aerospace industry of such variables as the war in Vietnam, Soviet technological advances, and the cold war are evaluated; and the conclusions and recommendations generated from this study are listed. H.S.W.

N66-30775# Oak Ridge National Lab., Tenn.
MATHEMATICS DIVISION ANNUAL PROGRESS REPORT, PERIOD ENDING DECEMBER 31, 1965
Apr. 1966 119 p refs
(Contract W-7405-ENG-26)
(ORNL-3919) CFSTI: HC $4.00/MF $0.75

Brief discussions of computing services carried out on the following are presented: AEC Weather Department, analytical chemistry, biology, budget and programs planning, chemical technology, chemistry, health physics, instrumentation and controls, isotopes, metals and ceramics, neutron physics, physics, reactors, reactor chemistry, reactor operations, solid state, and thermonuclear research. Statistical research, programming, and applications are discussed. NSA

N66-30794*# Midwest Research Inst., Kansas City, Mo.
PERSONAL INCOME AND POPULATION IN MISSOURI COUNTIES: 1950–1960.
1 Jun. 1966 31 p refs Appendix to NASA-CR-76250
(Contract NASr-63(04))
(NASA-CR-76329) CFSTI: HC $2.00/MF $0.50 CSCL 05C

This study was conducted to obtain annual personal income and population estimates in the 114 counties of the state of Missouri for the period 1950 through 1960. A by-product of the study was the development of a methodology by which reliable approximations of personal income may be made on a continuing basis. The methodology used in estimating wages and salaries, proprietors' income, nonfarm proprietors' income, property income, income from dividends and interest, transfer payments, and personal contributions for social insurance is discussed. Tabulated estimates of population and personal income are presented by county. R.N.A.

N66-31130# Stanford Univ., Calif. Inst. for Mathematical Studies in the Social Sciences.
ECONOMIC EQUILIBRIUM
Kenneth J. Arrow 31 Mar. 1966 35 p refs Submitted for Publication
(Contract Nonr-225(50))
(TR-142; AD-630666) CFSTI: HC $2.00/MF $0.50

A brief history of the concept of general economic equilibrium is presented, with special emphasis on the development of the field since 1932. This is followed by a fairly detailed survey of the present known results on the existence of competitive equilibrium and briefer surveys of other topics, specifically the optimality of competitive equilibrium, the concept of the core, uniqueness of competitive equilibrium, stability, comparative statics, and equilibrium over time. TAB

N66-31190# European Space Vehicle Launcher Development Organization, Paris (France).
CECLES-ELDO 1960–1965 Report to the Council of Europe 1965
23 Dec. 1965 99 p
CFSTI: HC $3.00/MF $0.75

This first ELDO (European Space Vehicle Launcher Development Organization) annual report covers the history of the organization from its inception and refers to the close relation between ELDO and its sister organization ESRO (European Space Research Organization) and to the first example which is proposed of the utilization of an ELDO launcher to place an ESRO satellite in orbit. It also gives an account of work at present in hand on the ELDO Initial Program. This paper also outlines proposals for the future which have reference to the main fields of application of space vehicle launchers at present foreseen, viz. scientific investigation, sponsored either by ESRO or by national programs, and applications to communication satellite systems under the aegis of the European Conference on Satellite Communications (CETS). I.M.

N66-31239# Technisch Documentatie en Informatie Centrum Voor de Krijgsmacht, The Hague (Netherlands).

DEFENSE CONSTRUCTION [KRIJGSBOUW-KUNDE] Literature Review

4 Jun. 1966 23 p refs In ENGLISH, DUTCH, and GERMAN *Its* Vol. 8, No. K.85

CFSTI: HC $1.00/MF $0.50

Abstracts and bibliographic notes are presented on the topics of cement, foundation mechanics and techniques, airports, photogrammetry and land surveying, civilian construction methods, radioactive fallout, and air raid shelters.

Transl. by J.O.

Collections of NASA Documents

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In addition, NASA regularly sends its publications to the Enoch Pratt Free Library located in Baltimore, Maryland.

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—NATIONAL AERONAUTICS AND SPACE ACT OF 1958

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